MAY 17 1948

ENGINEERING NEWS-RECORD

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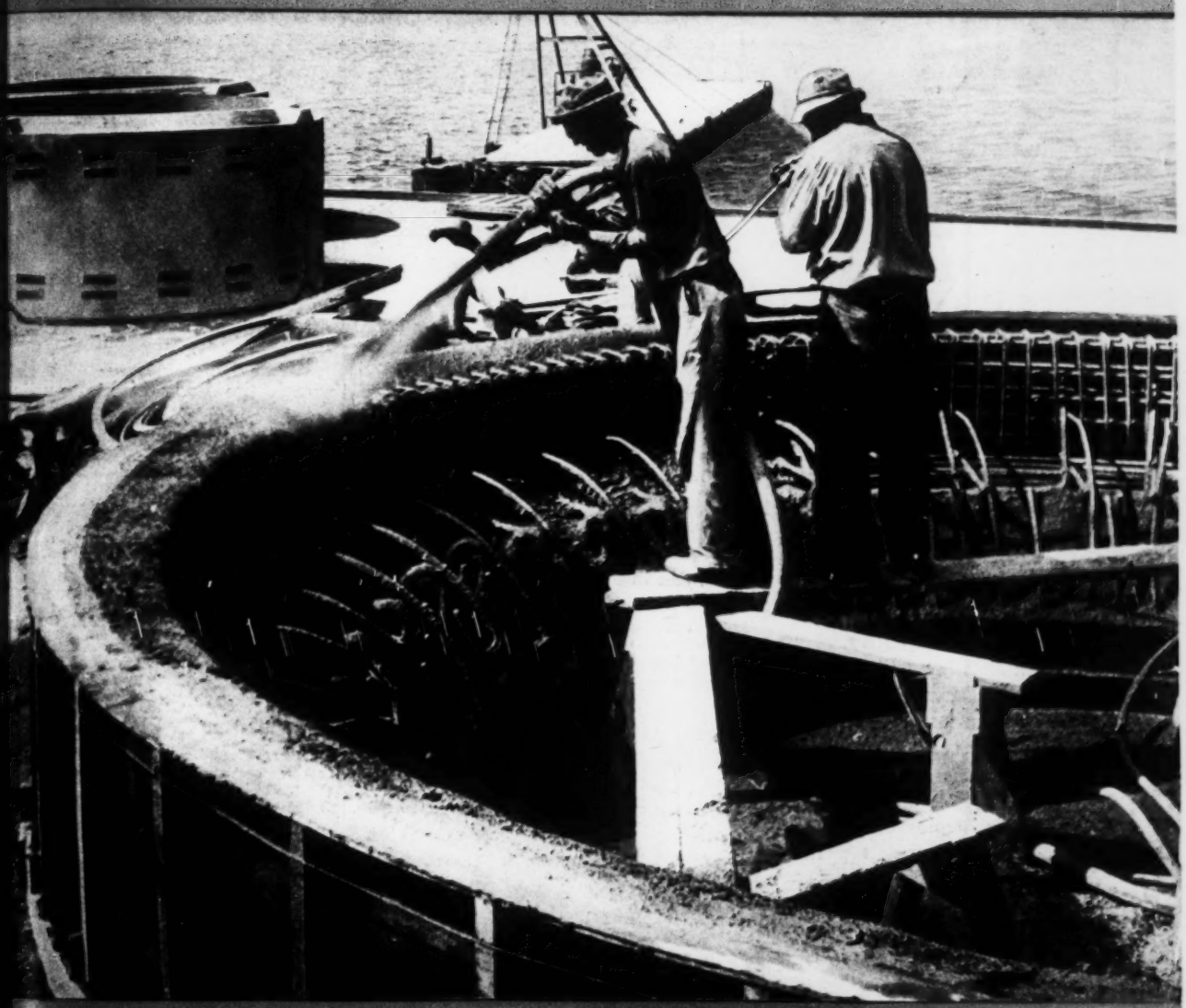
MAY 13, 1948



WATER INTAKES for California steam power station will be 10-ft. dia. reinforced concrete pipes

IN THIS ISSUE—

ENGINEERING AND THE WORLD BANK

REFUSE DISPOSAL PRACTICES AND COSTS

"BYERS WROUGHT IRON PIPE goes underground to stay in Sacramento

The water supply system recently installed to serve six tracts in East Sacramento, Calif.,—Arnold Tract #2, Mallegni Terrace, Meadow Lane, Miester #2, Garden Terrace, and Orchard Terrace—reflects the municipality's insistence on complete dependability. Byers Wrought Iron lapweld pipe, in 4, 6, 8, and 10-inch sizes, was installed by Luppen & Hawley for the underground runs. The pipe was dipped in asphalt and laid on sand, to supplement the inherent corrosion-resistance of the material, and obtain the maximum in endurance. Bartley W. Cavanaugh, City Manager, Carl M. Hoskins, Superintendent of the Water Works, and Fred J. Klaus supervised the installation.

DURABILITY PROVEN IN SERVICE

Records of old installations in California supply plenty of evidence to support this choice of wrought iron. In one area, a 200-foot section of 44" O.D. wrought iron pipe was recently removed, after 54 years of continuous service. No holes or thin spots could be found, and it was cleaned and placed in stock for subsequent use. The pipe used to replace the section was also wrought iron, reclaimed after it had been 30 to 40 years in service.

UNIQUE PROPERTIES

The composition and structure of wrought iron are duplicated by no other material, and so the resulting properties are unique. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack. They also anchor the initial protective scale, which shields the underlying metal.

ASK FOR BULLETIN

Our bulletin, "Wrought Iron for Underground Services", discusses factors influencing soil corrosion, and gives results obtained in various installations. A copy will be sent on request.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

ENGINEERING NEWS-RECORD

Volume 140 • Number 20 May 13, 1948

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News of the Week	53
Editorials	62
Twin Lines Supply Steam Plant Water	64
Dual-Lane Bypass Road At Norfolk	68
Volume Change of Marble May Measure Durability	69
World Bank Operations Rely on Engineering Studies	70
Concrete Difficulties In Maritime Provinces	74
Low-Cost Irrigation Flume Cover.....L. R. BURZELL	75
Laying 60 mi. of Prestressed Concrete Pipe	76
Refuse Disposal Practice and Cost	80
Vibration Testing of Friction Piles.....C. F. DODGE AND W. F. SWIGER	84
Limit Design of Prismatic Beams.....E. P. POPOV	89

DEPARTMENTS

Construction Trends	49	New Aids	104
Comment and Discussion	92	Manufacturers' Publications	122
From Field and Office	94	Men and Jobs	130
Book Notes and Review	95	Elections and Activities	134
Material Prices	98	Manufacturers' Activities	138

Construction Reports 167

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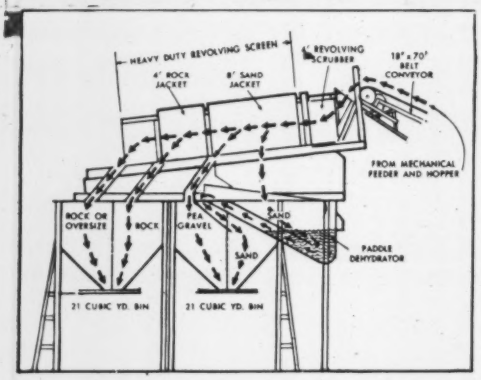

ASK ED LEARY of River Falls, Wisconsin about Pioneer Washing Plants. His plant, shown above, is producing three sizes of washed aggregate—1½", ¾" and sand for general construction and ready-mix concrete. Ed says, "Output—high! Maintenance—practically Z-E-R-O!"

4 SIZES OF AGGREGATE—scrubbed, washed, classified, and loaded. That's what this low-cost PIONEER Washing Plant will do for you. And it produces them—sand, pea gravel, and two sizes of rock—at a 50 to 75 ton an hour clip.

From the mechanical feeder to the four storage hoppers, engineered design and factory construction pay off. The PIONEER 305-W is quickly assembled and put to work, for all necessary drives, spouts and fittings are shipped with the plant.

The powerful *live water* action of the scrubbing and washing chambers breaks up chunks . . . loosens sticky material.

If you need washed aggregate for a job you'll be starting soon, ask your PIONEER distributor or write today for complete details about *Continuflo* Washing Plants. 60 to 90 day delivery.

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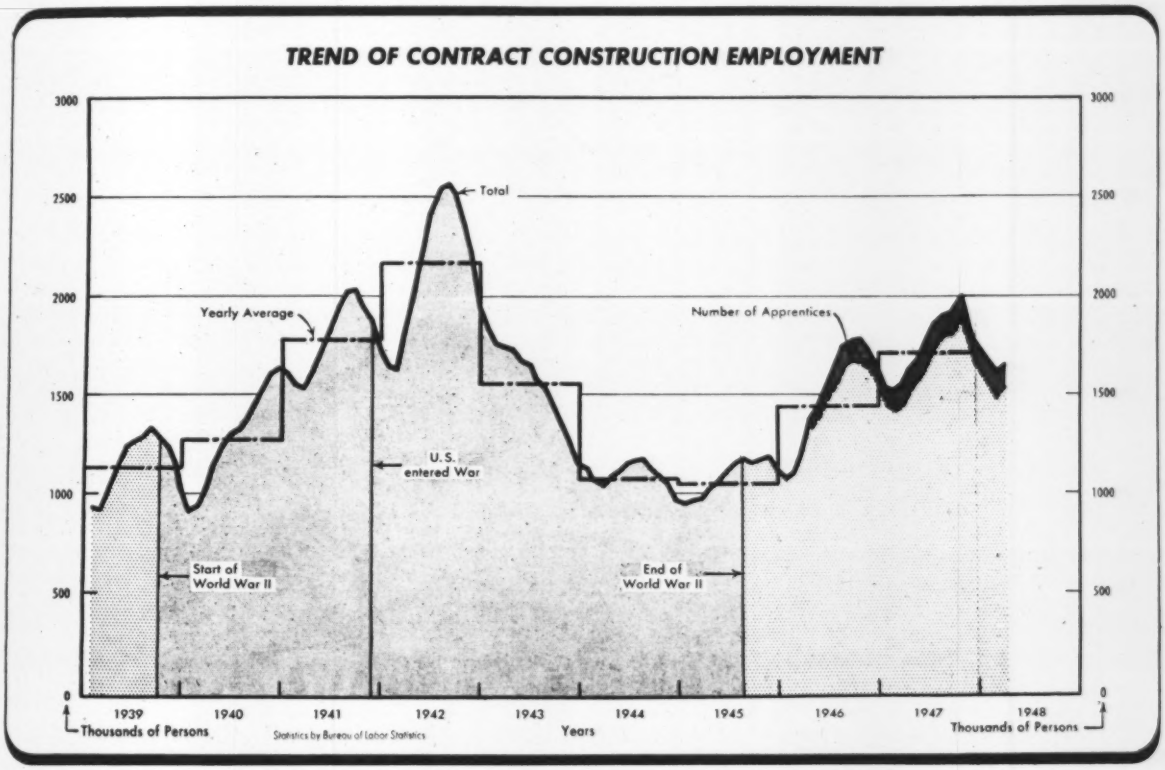
Higher Output, Lower Upkeep!

Pioneer

Continuflo **EQUIPMENT**

CONSTRUCTION TRENDS



Skilled Labor Shortage Accompanies High Construction Employment

With construction employment, estimated by the Bureau of Labor Statistics at 1,660,000 persons in March 1948 the highest for any March since 1943, a shortage in the supply of skilled labor still exists in such building trades as bricklayers, plasterers, electricians and plumbers. *Engineering News-Record's* survey of the supply of construction labor in 59 U. S. cities as of March 1, 1948 shows 35 cities reporting skilled labor shortages. Thus approximately 60 percent of the total of 59 cities reported shortages in the skilled labor supply. This compares with a ratio of approximately 75 percent on September 1, 1947, according to a similar survey made by *Engineering News-Record* at that time. Common labor is in good supply, short in only 5 of 59 cities.

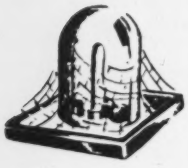
The training of apprentices has shown encouraging gains, with the Bureau of Apprenticeship of the U. S. Department of Labor reporting a record of 124,294 apprentices employed on April 1 in the building trades. This is an increase of nearly 10,000 apprentices in the total number employed over the March 1 figure of 114,822.

An analysis of the number of apprentices employed on April 1 by the various trades are as follows: woodworking trades, 44,721; pipe trades, 19,321; electrical trades, 18,163; trowel trades, 17,063; sheetmetal working trades, 9,620; painting trades, 8,955; and other building trades, 6,451.

Contract construction employment in March this year was 8 percent above the 1,533,700 persons employed in March 1947, 38 percent above the March 1946 employment figure of 1,203,200, 69 percent above the March 1945 figure of 984,600 and 56 percent above the March 1944 figure of 1,060,500. Compared with March 1943, when 1,764,100 persons were employed, employment in March 1948 showed a decrease of 6 percent.

Contract construction employment in the first three months of 1948 averaged 1,653,000, 9 percent greater than the average of 1,521,000 for the corresponding three-month period of 1947. The increase in employment as compared with a year ago is in keeping with the trend of construction activity as measured by *Engineering News-Record's* construction volume index. The construction volume index averaged 217 for the first three months of this year, 7 percent ahead of the first quarter average of 202 last year.

"Off AGAIN, ON AGAIN, GOIN' AGAIN" FINNEGAN

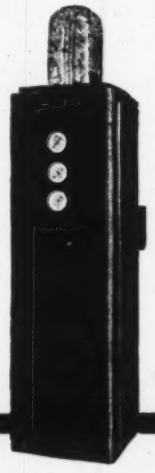


Mr. Finnegan's "short and sweet" wire to his section boss may aptly be applied to a W&T Visible Vacuum Chlorinator in intermittent service. The W&T Visible Vacuum Chlorinator can be turned on or off for long or short periods—yet, with but ordinary care, it will be "on the track" and ready to go at *all* times.

No "warm-up" time is necessary and there are no delicate parts to get out of order or become "frozen" during inactive periods—just turn it on when needed and watch this chlorinator "highball" along.

So for tough seasonal service—the hardest kind of chlorinator duty—as well as dependable continuous operation choose the visible vacuum principle backed by W&T's thirty-five years' experience.

Your W&T Representative can put you on the right track in selecting the right type for each particular job—ask him or write for the information you require.



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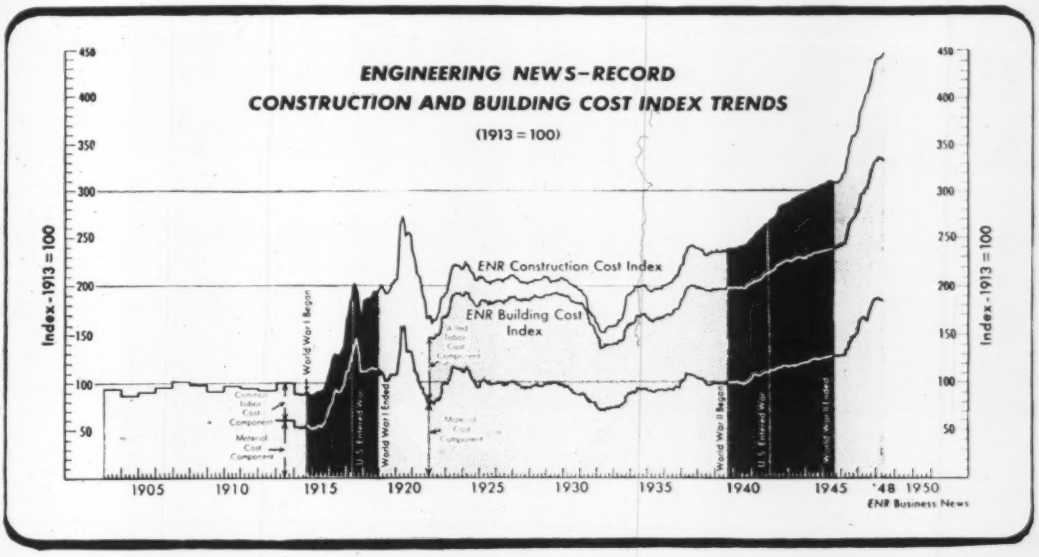
S-25

MAY CONSTRUCTION BUSINESS REPORT



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	April 1947 (4 wk.)	April 1948 (5 wk.)	% Change	Four Months 1947 (17 wk.)	Four Months 1948 (18 wk.)	% Change
Total U. S. Construction	$454,471	$777,159	+37	$1,642,347	$2,201,853	+27
Private Construction	213,667	391,268	+46	1,008,198	1,046,522	−2
Public Construction	240,804	385,891	+28	634,149	1,155,331	+72
Federal	65,983	114,886	+39	153,475	404,394	+149
E N R Construction Volume Index, 1913 = 100	245	302	+23	213	238	+12
Total New Productive Capital	$262,160	$446,838	+36	$518,164	$1,224,426	+123
Private Investment	262,160	446,838	+36	518,164	1,224,426	+123
Federal (non-federal work)						
Federal (federal work)						

CONSTRUCTION COSTS . . . WAGE RATES . . . MATERIAL PRICES

1913 = 100	May 1947	May 1948	% Change	Change April to May 1947 April	1947 May	%	1948 April	1948 May	%
E N R Constr. Cost Index†	399.98	447.86	+11.97	399.56	399.98	+0.11	443.64	447.86	+0.95
E N R Building Cost Index†	304.64	333.93	+ 9.61	305.21	304.64	−0.19	334.56	333.93	+0.19

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$1.140	$1.315	+15.35	$1.133	$1.140	+0.62	$1.287	$1.315	+2.18
Skilled Labor (Av. 3 Trades)	1.940	2.180	+12.37	1.934	1.940	+0.31	2.169	2.180	+0.51
Bricklayers	2.078	2.343	+12.75	2.072	2.078	+0.29	2.343	2.343	0.0
Structural Ironworkers	1.943	2.192	+12.82	1.937	1.943	+0.31	2.178	2.192	+0.64
Carpenters	1.799	2.006	+11.51	1.793	1.799	+0.33	1.986	2.006	+1.01
Cement, bulk, per barrel	2.51	2.81	+11.95	2.50	2.51	+0.40	2.81	2.81	0.0
Structural Steel, base	2.50	2.75	+10.0	2.50	2.50	0.0	2.80	2.75	−0.79
Sand, per ton	1.768	1.951	+10.35	1.768	1.768	0.0	1.943	1.951	+0.41
Lumber, 2x4 Fir, per M ft.	88.34	96.16	+8.85	88.64	88.34	−0.34	96.46	96.16	−0.31
Lumber, 2x4 Pine, per M ft.	83.47	88.77	+6.35	84.54	83.47	−0.08	88.77	88.77	0.0
Common brick, per M	22.83	25.375	+11.15	22.80	22.83	+0.13	25.375	25.375	0.0
Ready-mixed concrete, c.y.	8.829	9.951	+12.71	8.842	8.829	−0.15	9.982	9.951	−0.31
Struct. clay tile, 3x12x12	116.02	124.03	+6.90	116.02	116.02	0.0	123.47	124.03	+0.45

MATERIAL SHIPMENTS . . . BUILDING PERMITS

	April 1947	April 1948	% Change	March 1948	% Change Mar. to Apr.
Steel (% operating capacity) A.I.S.I., weekly average	95.0	80.6	−15.2	94.8	−15.0

	February 1947	February 1948	% Change	Twelve Months 1946	Twelve Months 1947	% Change
Cement, thous. bbl. U. S. B. of Mines	8,363	9,205	+10.1	169,336	187,396	+10.7

	March 1947	March 1948	% Change	Three Months 1947	Three Months 1948	% Change
Fabricated Structural Steel, tons, A.I.S.C.	137,799	158,133	+14.8	409,330	441,123	+7.8
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$235,063	$338,611	+44.1	$558,694	$860,916	+54.1

COST OF LIVING INDEX . . . . EMPLOYMENT

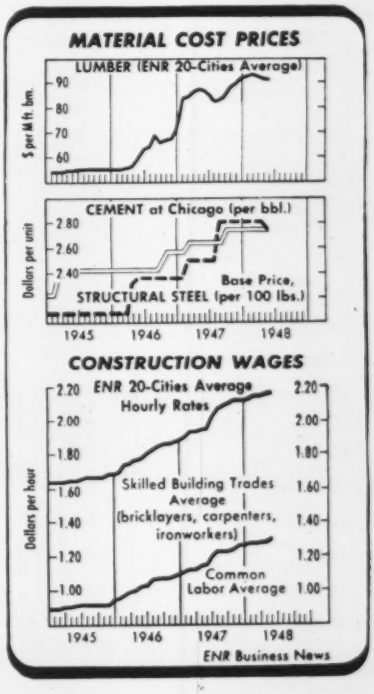
Base 1935–39 = 100	1941	March 1947	March 1948	% Change	February 1948	% Change Feb. to Mar.
Consumers' Price Index, B L S	105.2	156.3	166.9	+6.8	167.5	−0.4
Rent (Housing) Index, B L S	106.2	109.0	116.3	+6.7	116.0	+0.3

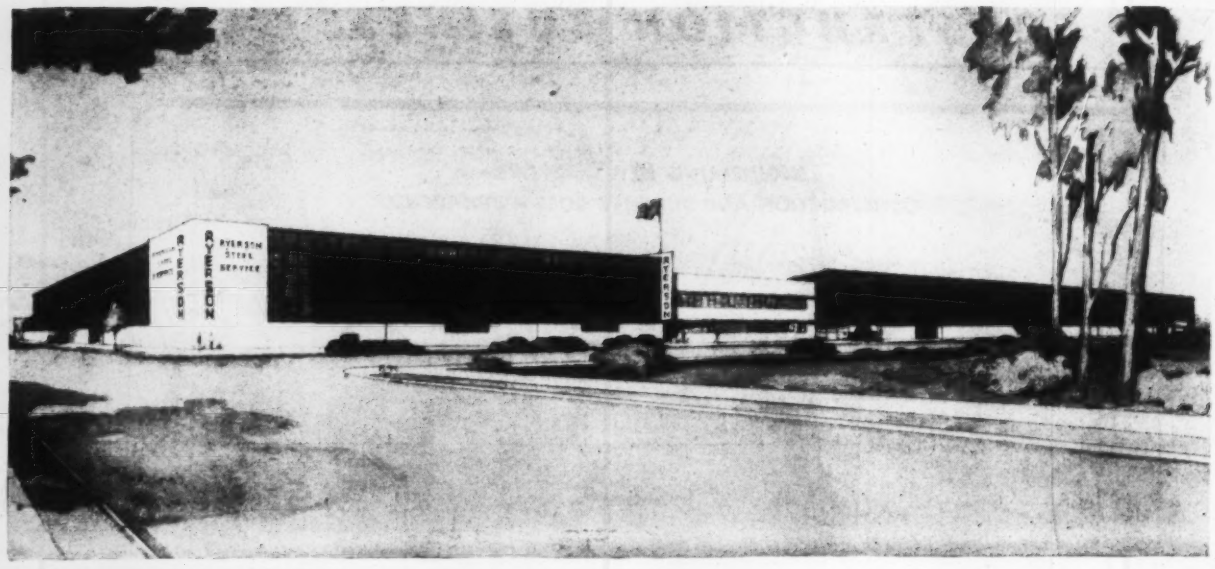
	March 1947	March 1948	% Change	February 1948	% Change Feb. to Mar.
Contract Constr. Employ. (est.), thous., B L S	1,534	1,660	+8.2	1,607	+3.3

ENR INDEX NUMBERS*

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
May 1948	447.86	215.29	333.93	180.51		
Apr., 1948	443.64	213.26	334.56	180.85	302	132
Mar., 1948	443.60	213.24	334.22	180.67	247	108
Feb., 1948	442.67	212.79	335.49	181.36	231	101
Jan., 1948	441.65	212.30	333.58	180.32	173	76
Dec., 1947	441.13	212.05	333.06	180.04	246	108
Nov., 1947	436.91	210.02	329.22	177.97	234	103
Oct., 1947	434.58	208.90	327.29	176.92	228	100
Sept., 1947	426.38	204.96	322.58	174.38	250	110
Aug., 1947	422.85	203.26	317.75	171.77	211	93
July, 1947	413.75	198.89	308.90	166.98	218	96
June, 1947	406.63	195.47	307.42	166.18	274	120
May, 1947	399.98	192.27	304.64	164.68	222	97
Apr., 1947	399.56	192.07	305.21	164.99	245	107
Mar., 1947	395.45	190.09	303.28	163.94	218	96
Feb., 1947	393.73	189.27	301.56	163.01	195	86
Jan., 1947	386.97	186.02	294.62	159.26	192	84

* *1947–1948 indexes revised.*





Announcing

Another Ryerson Steel-Service Plant for the West Coast

We are glad to announce the opening of a new Ryerson steel-service plant in Emeryville, California, just across the bay from San Francisco.

This newest unit in the nation-wide Ryerson network offers quick shipment of every kind of steel to the expanding industry of northern California and the whole Pacific Northwest. Like its twelve sister plants, the San Francisco unit is expertly staffed and excellently equipped. Like the others, it features a service perfected by more than a hundred years in the business of steel distribution.

The largest steel stocks in America are carried in Ryerson plants strategically-located from coast to coast. Because of current demand, the exact steel you need may not always be on hand. But our stocks turn quickly. A size that's out today may be in tomorrow. So you will find that we can usually take care of your requirements.

Call us for steel from stock—a single piece or a truckload. We will do everything possible to deliver the steel you need when you need it.

Joseph T. Ryerson & Son, Inc. Plants at New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco.

PRINCIPAL PRODUCTS: Carbon Steels • Alloy Steels • Allegheny Stainless • Tool Steel Bars • Structurals • Plates • Sheets • Mechanical Tubing • Boiler Tubes & Fittings Reinforcing Bars • Safety Floor Plate • Babbitt Metal • Solder • Machinery & Tools, Etc.

RYERSON STEEL

New Construction Volume in April

Civil engineering construction volume in continental United States totals $777,159,000 for April, an average of $155,432,000 for each of the five weeks of the month. This average is 22 percent above the average for March, 1948 and 37 percent above the average for April, 1947, according to *Engineering News-Record*.

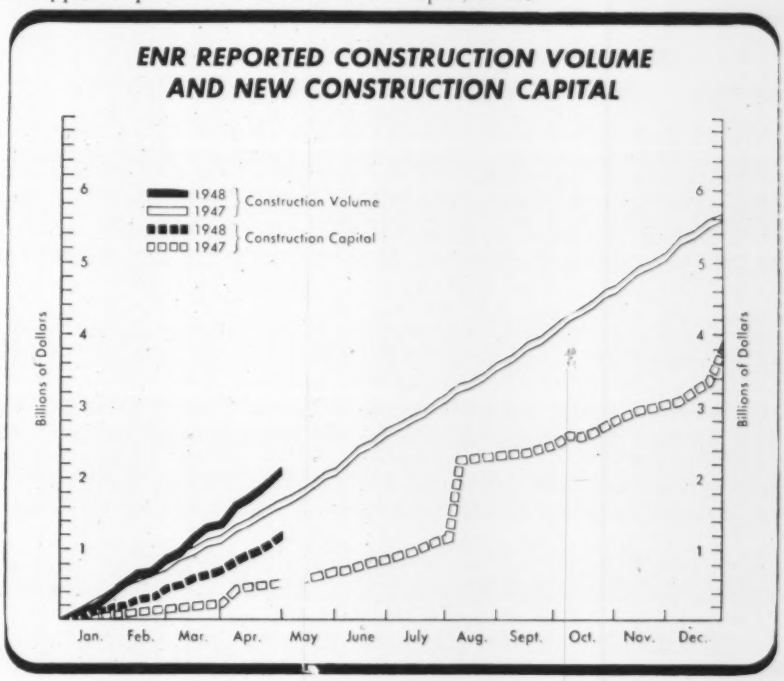
Private consrtuction for April on a weekly average basis is 42 percent above last month and 46 percent above April, 1947. Public construction is 7 percent above last month and 28 percent above last April. State and municipal construction is 15 percent above last month and 24 percent above the average for April, 1947. Federal construction, down 7 percent from last month, is 39 percent above April, 1947.

Weekly averages in the various classes of construction for April, 1948 compared with March, 1948 show gains in waterworks, 12 percent; sewerage, 73 percent; highways, 18 percent; earthwork and drainage, 15 percent; industrial buildings, 175 percent; commercial buildings, 21 percent; public unclassified, 16 percent. Losses are recorded for public bridges, 28 percent; public buildings, 5 percent; and private unclassified, 67 percent.

Geographically, four sections showed gains in April, 1948 over March—New England, 118 percent; South, 36 percent; Middle West, 172 percent; West of the Mississippi, 34 percent. Middle Atlantic dropped 8 percent; and Far West 15 percent.

Five sections made gains in April over April, 1947—Middle Atlantic, 40 percent; New England, 100 percent; South, 60 percent; Middle West, 44 percent; West of the Mississippi, 37 percent. The Far West showed a drop of 3 percent from last year.

New capital for construction for the five weeks of April, 1948 totals $146,838,000 or a weekly average of $89,368,000 for the month. The weekly average is thus 27 percent abov the weekly average of $70,132,000 for March, 1948 and 36 percent above the weekly average of $65,540,000 for April, 1947.



ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—APRIL, 1948

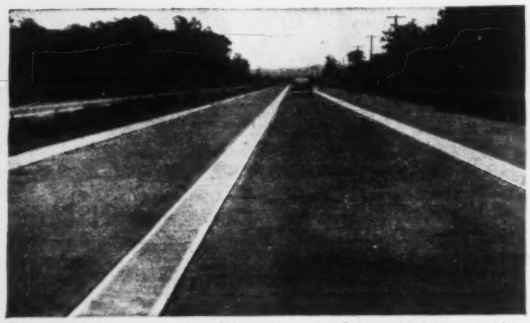
Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—Waterworks, excavation, drainage and irrigation,* $28,000; *other public works* $50,000; *industrial buildings,* $68,000; *other buildings,* $250,000

Five Weeks—Thousands of Dollars (000 Omitted)

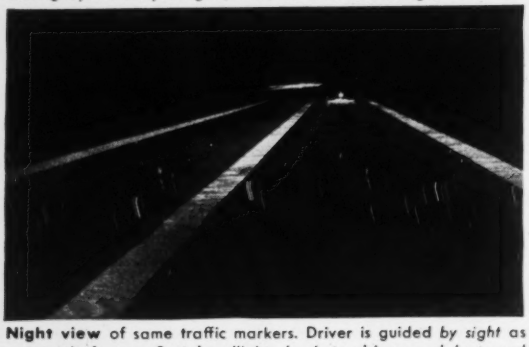
	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States April 1948	United States Four Months 1948	United States Four Months 1947	Canada
Public Works										
Waterworks	28	4,320	2,893	3,255	3,221	2,007	15,824	56,468	44,496	455
Sewerage	290	2,661	3,808	5,799	4,646	16,794	33,998	74,915	29,506	1,383
Bridges, public	14,133	3,485	6,334	774	2,809	2,210	29,745	95,570	50,706	176
Earthwork and waterways	115	2,326	5,305	722	50,317	8,014	66,799	211,180	83,409	249
Streets and roads	3,760	26,869	18,095	15,728	25,819	16,566	106,837	285,060	202,200	3,415
Buildings, public	1,512	26,470	12,830	20,209	15,630	30,131	106,782	354,942	159,557	4,737
Unclassified, public	4,882	2,040	3,106	3,445	5,155	7,278	25,906	77,196	65,275	1,515
Total public	24,720	68,171	52,371	50,032	107,597	83,000	385,891	1,155,331	634,149	11,930
Federal government (included in above classifications)	312	18,118	7,134	7,036	58,431	23,855	114,886	404,394*	153,475	.....
Private										
Bridges, private	.....	50	.....	300	50	.....	400	400	463	50
Industrial buildings	3,603	9,114	61,626	54,442	24,823	9,289	162,897	326,368	336,777	15,000
Commercial buildings	6,855	115,111	27,107	13,862	38,478	13,874	215,287	635,187	595,440	2,389
Unclassified, private	160	792	4,262	878	5,215	1,377	12,684	84,567	68,527	648
Total private	10,618	125,067	92,995	69,482	68,566	24,540	391,268	1,046,522	1,008,198	18,087
Total Engineering Construction:										
April, 1948 — 5 weeks	35,338	193,238	145,366	119,514	176,163	107,540	777,159	.....	.....	30,017
March, 1948 — 4 weeks	12,946	168,905	85,239	35,144	105,001	100,861	508,096	.....	.....	15,683
April, 1947 — 4 weeks	14,146	109,764	72,615	66,253	102,612	89,081	454,471	.....	.....	33,012
Four Months — 1948	103,309	601,665	398,863	246,460	548,969	302,587	.....	2,201,853	.....	117,371
Four Months — 1947	63,034	437,297	280,537	217,520	330,849	313,110	.....	.....	1,642,347	139,278

SINGING HIGHWAY SOUNDS KEYNOTE OF SAFETY

NEW DOUBLE-DUTY TRAFFIC MARKER GUIDES DRIVERS BY SOUND AND SIGHT . . . BOTH DAY AND NIGHT



Daytime view of two traffic markers on 3-lane highway in New Jersey shows contrast of Atlas White Cement against regular pavement gray. Visibility is high. (White Concrete Reflecting Curb at left.)



Night view of same traffic markers. Driver is guided *by sight* as saw-tooth faces reflect headlights back to driver, and *by sound* should car veer out of lane and tires pass over corrugated surface.

Ribbed and white, this new traffic lane separator does double safety duty. Both by day and by night, it clearly defines the road ahead . . . and hum-m-ms a warning when drivers steer out of lane.

Made with Atlas White Cement, the slightly corrugated surface of this traffic marker is built flush with the highway level. By day, its white visibility is unmistakable. By night, independent of overhead illumination, its saw-tooth faces catch headlight rays, reflect them *back* to the driver, and form a guiding ribbon of light.

In addition, by day or by night, in weather that may be clear, rainy or foggy, should the driver veer out of lane, the ribbed surface causes a distinct hum or whine when tires ride the corrugations.

Thus, by sound and sight, both day and night, drivers are doubly guided in keeping their cars in lane. Traffic is channelized, moves faster and safer. Highway capacity is increased.

Send for new descriptive booklet. Write to Atlas White Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

ENR-TM-2

ATLAS WHITE CEMENT
for Double Duty TRAFFIC MARKER

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—ABC Network*

News of the Week

ENGINEERING NEWS-RECORD • MAY 13, 1948 • VOLUME 140 • NUMBER 20

Biological warfare hazards assayed by waterworks men

American Water Works Association speakers find cause for alarm in possibility of new chemical and bacterial agents directed toward contamination of water supplies

Municipal water supply systems might furnish a means for an enemy to deal death on a wholesale scale, unless effective protective measures are provided to cope with new chemical and biological weapons, members of the American Water Works Association were told last week.

Addressing sessions of the AWWA national convention at Atlantic City, N. J., H. H. Gerstein, chief filtration chemist, and R. E. Noble, principal filtration bacteriologist for the Chicago Department of Public Works, conjured a grim picture of potential hazards. Both men expressed the hope that the National Security Council would find it expedient to acquaint keymen in the waterworks profession with information on precautionary and defensive measures. If such information is lacking, both urged that steps be taken to acquire and disseminate it through proper channels as soon as possible.

Pointing to the limited information released on bacteriological warfare—considered to be one of the most closely guarded matters affecting national security—Messrs. Gerstein and Noble said they had made their appraisal solely from published articles. Some of the latter, however, have not had wide circulation they said, with the result that the implications have escaped attention.

Even after discounting what they termed the "apparently fantastic statements" relating to the development of chemical and biological warfare agents, the Chicago water purification experts said they were forced to the conclusion that "the potentialities for destruction and devastation of life and property (by such agents) are such that they cannot be ignored."

To illustrate, they cited a report that methods have been developed for the mass-production of crystalline botulinus toxin, and that one gram of this product represents 7,000,000 lethal doses. Based on this data, it was calculated that one pound of botulinus toxin evenly dispersed in a water supply, would contaminate approximately 42,000,000 gallons to the extent that drinking 50 cc. (a couple of good swallows) would provide a lethal dose.

Also mentioned was the announcement made by Northwestern University, Chicago, that its chemists had isolated a poison from a substance secreted by certain types of shellfish which is of such toxicity that "one-quarter pound dropped into the water supply of a city of 100,000 would kill every inhabitant."

Another focus on the problem of dealing with new contaminants in water supplies was furnished by Arthur E. Gorman, sanitary engineer of the Atomic Energy Commission, Washington, D. C.

In the case of a national emergency, he said, the now limited knowledge of precautions to be taken and the safeguards to be instituted to protect the public against the hazards of radioactive materials must be extended as an essential item of national security.

Training of young men in the waterworks and sanitary engineering profession in the basic principles of nuclear physics and the application of new developments in atomic energy to their field of interest was cited as a most important responsibility of the industry, the schools, and the AEC.

Progress on disposal

Mr. Gorman's remarks on progress being made toward the control and disposal of radioactive wastes products were a little more optimistic in promise than the report made by another staff member of the AEC a few weeks ago (*ENR* April 22, vol. p. 593) who pointed to the problems that were being faced in connection with those matters. Said Mr. Gorman:

(*Continued on page* 58)

Railway engineers in bargaining unit

One hundred and fifty engineering employees of the Chicago and North Western Ry. have joined the Technical Engineers' Group of the American Railway Supervisors Association and have entered into a collective-bargaining agreement with the railway that became effective on April 16.

The association is open to all men classified as employees and subordinate officials by the Interstate Commerce Commission. In the engineering department of the general offices of the company, this includes the office engineer in the bridge department, but not the office engineer in the chief engineer's office, assistant engineers, the general bridge inspector and men in subordinate positions. In division offices, this classification includes assistant engineers, instrumentmen, rodmen and tapemen. Cost engineers in the audit department also are included.

The ARSA was organized 13 years ago and has a membership of 5,000. It includes in its membership mechanical foremen, yardmasters, storekeepers, station masters, structural-steel foremen, and roadmasters. Extension to include engineering employees is relatively new, engineers on the Grand Trunk Ry. being the first to join, according to Leo D. Garis, president of the C&NW group. The C&N.W.Ry. is the first of the railroads having headquarters in Chicago to enter into a collective-bargaining agreement with the association as representative.

The ARSA is independent of the AFL or CIO. Its agreement with the railroad covers compensation, working time, vacations, seniority, transfer, and expenses when away from headquarters. No expiration date is included, but the agreement may be annulled following 30-day notice from either party.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public Construction—Plans are being considered for a $1,000,000 building program at Meyer Memorial Hospital, *Buffalo, N. Y.* . . . *West Chester, Pa.*, and four adjoining townships have voted a million-dollar bond issue for a consolidated high school. . . . A $2,000,000 wing for St. Luke's Hospital, *Denver, Colo.*, will contain a 200-bed unit . . . Butler University, *Indianapolis, Ind.*, will build a $1,000,000 student union building.

Industrial Construction—The *Toledo, Ohio*, refinery of the Sun Oil Co. will undergo a $16,000,000 expansion in the next two years. Gulf Refining Co. is also expanding its Toledo refinery at a cost of $1,400,000 . . . Ohio Public Service Co. will build a $13,000,000 electric power station at Dillies Bottom, across the Ohio River from *Moundsville, W. Va.* . . . Work will start soon on a $35,000,000 telephone equipment manufacturing plant for the Western Electric Co. near *Indianapolis, Ind.* . . . Work has started on a 45,000-kw. turbine generator plant for the *Hartford, Conn.* Electric Light Co. Stone and Webster has the contract.

Housing—First apartment units are now being occupied in an 800-family project at *Fair Lawn, N. J.* . . . Ground has been broken for a $6,500,000 garden-type housing project in *Bergenfield, N. J.* It will house 636 families . . . On May 22 demolition of old houses will be started to clear the site of the Winbrook low rent apartments at Grove Street and Fisher Ave., *White Plains, N. Y.* There will be five 9-story buildings with 450 apartments . . . M. S. Kelliher Co. has a contract for 36 two-family houses in the Mattapan section of *Boston, Mass.*, to cost about $19,500 each . . . Bel Crest Corp. plans a new $2,500,000 subdivision of 280 single-family dwellings and 28 multiple units at *Los Angeles, Calif.* . . . A new rental housing project has been approved for *Terre Haute, Ind.*, to be called Parkway Apartments and financed by the Lincoln National Life Ins. Co. . . . Wellesley Homes, Inc., is building 133 houses at *Spokane, Wash.*, to cost over $1,250,000 . . . Three Colorado contractors have announced housing developments in *Aurora, Colo.*, to cost $4,000,000 and offer 355 single-family homes. They are: The Mark Waggener Realty Co., 193 homes, N. F. Tucker, 92, and Charles T. Gore, 70.

Highways—*Indiana* is spending about $2,000,000 to repair winter damage to state roads . . . *Manitoba* has voted a total of $7,734,092 for 1948-49 road work . . . More than 500 truck drivers have been arrested on *Minnesota* highways this spring for violation of load limits . . . Massachusetts highways are not only inadequate to handle modern traffic but constitute a grave threat to national security, in the opinion of Maj. Gen. Frank A. Keating of the First Service Command.

Water Supply and Sewers—A three-year, $5,613,008 program of expansion has been outlined for city water facilities of *Dayton, Ohio* . . . The Western N. Y. Water Co. *Buffalo, N. Y.*, plans to spend over $7,500,000 in plant additions . . . *Defiance, Ohio*, has set up new charges for consumer tapping of new water mains. Domestic taps will be $325 each. . . . The *Seattle, Wash.*, water department plans to spend an average of $1,500,000 annually for the next 15 years on an expansion program.

Miscellany—Plans to spend more than $1,000,000 to eliminate floods in the Lower Nemaha River Valley have been approved by a group of *Richardson County, Neb.* landowners. . . . The *Pennsylvania* Forests and Water Department will build five silt-impounding reservoirs along the Schuylkill River between Pottsville and Reading.

Congress asked for $417,620,000 for military public-works projects

Approved by Armed Services Committee, bills call for much construction for Army, Navy and Air Force

Introduced in Congress recently, and approved by the House Armed Services Committee, were two bills authorizing $417,619,850 of military public works construction by the departments of the Navy, Army and Air Force.

The new bills (H. R. 6341 for Navy construction, and H. R. 6342 for the Army and Air Force) supersede two measures introduced at the last session. They are similar to the older bills except for the reduced amounts listed for many proposed projects. Congress balked at authorizing these projects last year because the amounts requested were too high. The new bills reduce the authorizations by about $81,000,000.

The Navy's Bureau of Yards and Docks will be given authority to construct $92,932,600 of public works in the continental U. S. and $116,756,900 at overseas installations, if the bill for that department is passed without major change. H. R. 6342 will permit the Corps of Engineers to undertake construction amounting to $85,886,000 in the U. S. and $122,044,350 in projects outside the country.

Much housing work

By far the biggest part of the construction abroad consists of housing for military personnel.

The largest single group of facilities the Navy will construct in this country is for the naval air missile test center, Point Mugu, Calif., to cost $30,000,000. An aeronautical turbine laboratory to cost $22,750,000 at Trenton, N. J., is also proposed. Other U. S. projects include: Naval Academy, Annapolis, Md., $12,000,000; radio transmitting station (location to be determined), $7,000,000; White Sands Proving Ground, New Mexico, $6,194,730; and naval ordnance test station, Inyokern, Calif., $3,670,500.

Large overseas construction by the Navy will include $25,000,000 for hospital facilities at the medical center on Guam; $21,000,000 for work at Apra Harbor, Guam; $14,675,000 for buildings at the naval supply center, Guam; $11,296,000 for the naval operating base, Adak, Alaska; $10,000,000 for the naval ammunition depot, Guam; $5,823,000 for the Guam fleet marine force base, and $5,750,000 for the Guam naval radio station.

For the Army, the Corps of Engineers will construct a number of large projects in the United States and abroad. Those listed for this country include: Rapid City airfield, S. D., $5,000,000; Camp Hood, Tex., $4,455,950; White Sands, N. M., $3,887,430; U. S. Military Academy, West Point, N. Y., $3,249,750; Camp Lee, Va., $2,902,870; Fort Knox, Ky., $2,833,380.

Outside the country the corps will expand Ladd Field, Alaska, to the amount of $20,694,850; Harmon Field, Newfoundland, $12,087,100; Keflavik airport, Iceland, $10,352,100; Fort Richardson-Elmendorf field, Alaska, $10,190,375; Air Force bases, Marianas, $5,376,708; Whittier, Alaska, port facilities, $5,332,277; Adak Army base, Aleutian Islands, $4,334,600; Army airfield, Fort Yukon, Alaska, $4,160,950; ground force bases in the Marianas, $3,803,940; and Tripler General Hospital, Hawaii, $3,472,960.

Highway transport congress told of continuing shortage of needed roads

Physical deficiencies of road system and legal restrictions on truck and bus operators discussed by National Highway Users Conference

The people of the United States must expect a continuing shortage of adequate highways just as they must look forward to continuing scarcities of steel, food or clothing, members of the National Highway Users Conference were told by speakers at their second Highway Transportation Congress in Washington May 6-7.

Alfred P. Sloan, Jr., head of the General Motors Corp. and retiring chairman of the conference, made this point in his opening talk, stressing the importance of determining what are the nation's most vital highway needs. Because of the demands on the U. S. for foreign relief and rehabilitation, any attempt to meet more than these needs will constitute a real threat to the national economy, Mr. Sloan said.

Similar views were expressed by Alexander Fraser, president of the Shell Union Oil Corp. and new chairman of the Automotive Safety Foundation. "The public must be asked for patience and tolerance for our highway departments and highway engineers. These men have exercised commendable restraint by not plunging headlong into road construction in the face of shortages of men and materials, and inflated costs."

Deficiencies to continue

It will take years to make up accumulated deficiencies, according to G. Donald Kennedy, ASF vice-president. Hence the need for sound planning and studies of fiscal and administrative matters as well as engineering. It is essential, he said, that there be a proper balancing of state, county and city needs.

Discussing means of meeting these needs, H. S. Fairbank, deputy commissioner of the Public Roads Administration, said that the Interstate Highway System provides continuous routes which, within the smallest compass of mileage, are capable of contributing most to the national aggregate of transportation service. The roads of this system traverse counties that yield nearly half the country's agricultural production.

However, Mr. Fairbank cautioned against blindly concentrating all expenditures at this time on roads designated for that system. These roads, he said, are not invariably the most useful in the areas they traverse, hence concentrating funds on them might result in inefficient use of available money.

A. S. Goss, master of the National Grange, observed that the shrinking farm population makes it increasingly difficult for the rural population to provide roads to move its crops to market. Also, he said many farmers hold that the standards that have been set for farm-service roads are too high.

J. Clark Akers, highway engineer of Davidson County, Tenn., advocated stage construction for secondary roads, and designs based on the maximum use of locally available materials "however unorthodox that plan may be." Strong support came from H. Willis Tobler, assistant director, Washington office, American Farm Bureau Federation, who said that one of the main obstacles to development of an all-weather system of local rural roads is lack of authority in the states and local subdivisions to determine the standards for the federal-aid secondary roads.

Congestion in cities

If congestion on highways built into and through cities under the federal-aid program is to be relieved permanently, as many of those roads as possible should be limited as to access, according to Park H. Martin, executive director of the Allegheny Conference on Community Development. Otherwise, he said their capacity will be quickly impaired. Mr. Martin also stressed the need for adequate parking facilities in cities.

In a similar vein, John V. Lawrence, managing director of the American Trucking Associations, Inc., pointed out that the real terminals for trucks entering a city are the business houses or factories to which their loads are consigned, hence little is to be gained by facilitating their movement into a city if they are kept from reaching their destination by parked cars.

Restrictions Criticised

Load restrictions that are less than the actual capacity of a highway were sharply criticised by L. C. Allman, vice president of the Freuhauf Trailer Co. It is time for all states, he said, to take a scientific rather than a political approach to this subject. At this time, when every effort is being directed toward increasing the nation's productive capacity, he added, artificial restrictions on the transportation capacity of highways should not be tolerated. He proposed an 18,000-lb. axle-load for all new construction, with a minimum axle spacing of 42 in. and not more than four axles within any 24 ft. He also favors a width limit of 102 in.

George M. Eichler, general council of the New Jersey Motor Bus Assn., recommended authorizing the operation of buses 40 ft. long and 102 in. wide. Such buses could operate safely on modern highways, he said, but would have difficulty in the 118 or 120-in. lanes in New York's Holland and Lincoln tunnels.

Pennsylvania starts two-year traffic survey

The Pennsylvania Department of Highways last week had started a two year, statewide traffic survey to provide density counts on about 34,000 miles of state highways. All improved surfaced highways will be included.

Continuous counts will be made by the department's 30 permanently-located electric-eye recorders, now in operation throughout on major traffic routes, secondary roads, farm-to-market highways, and recreational roads. Four major control stations will be established in each of twelve highway districts. A 24-hour manual count will be taken on two week-days, Saturdays and Sundays, six times during the year in alternate months, on roads having an average traffic volume in excess of 2,000 vehicles daily.

Manual counts also are planned at stated intervals.

Stone dust conductor causes fatal accident

Sandstone dust acted as a conductor which grounded a 220,000-volt transmission line recently during drilling and blasting operations on the Whitaker Summit highway project in Southern California. A workman was killed.

The accident occurred just after the workman fired a light springing charge in a vertical hole which at the surface was about 50-ft. below the power line. The resulting column of dust rose, contacted the line and carried a flash arc to the ground near the workman.

The contractor, Winston Bros. Co. of Minneapolis, Minn., now is covering all springing operations near high-tension wires. Winston's report says: "The lesson to be learned in this case is that dust around high tension power lines can be a direct hazard to operations, as a sufficient concentration of dust can carry an arc."

Holds carpenter group violates picketing ban

NLRB examiner declares Alabama carpenters violate Taft-Hartley provisions—Other labor news.

In a second decision involving the locals of the carpenters union, an examiner for the National Labor Relations Board last week had held that picketing of a Montgomery, Ala., department store was a violation of the Taft-Hartley labor law.

Previously (*ENR* May 6, vol. p. 677), another NLRB examiner had held a local of the same union in violation for secondary picketing of a prefabricated housing construction job in Missouri.

In the Alabama case, a federal court last February enjoined picketing of the Montgomery Fair Co.—a department store—by the carpenters. The NLRB trial examiner found that the union called a strike of its men in the store to force the store management to stop dealing with Bear Bros., Inc., a building contractor hiring non-union carpenters to do some renovation work. The trial examiner recommended that the national board force the union to stop picketing the store, and halt its efforts to interfere with the store's business with the Bear Co.

Other developments

Numerous other labor developments during the week included:

The Des Moines, Iowa, Master Builders Association approved a 10 percent increase in 1948 wage contracts for five major building trades unions. Unions completing negotiations included the carpenters, structural iron workers, equipment operators, plasterers and lathers. Similar agreements were negotiated in independent conferences with the plumbing and roofing unions.

Vancouver, B. C., painters accepted a pay increase tied to a cost-of-living index that gives union members an initial increase of 13 cents an hour; virtually all work at the site of Wolf Creek Dam, in Jamestown, Ky., remained halted last week when the common laborers union refused to renew its expired contract and craft unions joined the strike; construction of a new Veterans hospital in Buffalo, N. Y., was among the many jobs in that area that came to an almost complete standstill when Buffalo building labor men walked out a week ago.

Some 200 members of the operating engineers local at Fort Wayne, Ind., went on strike against the Associated Building Contractors of Fort Wayne after the union rejected a wage increase offer of 20 cents an hour in lieu of the union demand for 35 cents. In Boston, bricklayers ended a month-long strike when they accepted new wages of $2.50 per hour. The contractors offered 25 cents over the current hourly rate, which is still 10 cents below the union demand.

All building trade employees in the Milwaukee, Wis., area received at least a 20 cent-an-hour increase beginning April 1 under terms of a recently signed agreement. Carpenters in three Pacific Northwest cities were granted wage increases, but the Seattle, Wash. Building Trades Council agreed to waive a 6½ cent increase. Carpenters at Ellensburg and Yakima, Wash. ended a month long strike when they were granted a new scale of $2 an hour until June 1, and $2.06½ an hour for the twelve months after June 1. Moscow, Idaho, carpenters will receive $2 an hour until August 1, and $2.06 an hour from then until May 1, 1949.

Fostoria, Ohio, carpenters union men reduced their hourly rate from $2.30 to $1 on all "new frame dwelling construction." The 31-member local said it was making its contribution to the "definite need for homes at a price the average citizen can pay."

Sioux Falls, S. D., carpenters, plumbers and electrical workers continued negotiations with contractors, despite the fact that their previous contracts had expired; but at St. Louis, Mo., some 400 building laborers and hod carriers quit work on various jobs in protest against the failure of contractors to sign new wage agreements. And at Niagara Falls, N. Y., some 600 carpenters returned to work following a "satisfactory" wage settlement.

More than 180 painters and paperhangers were idle in Erie, Pa., after negotiations with the Erie Construction council reached a deadlock.

At Toledo, Ohio, hourly wage rates for about 4,000 construction workers were increased an average of 15 to 18 cents in informal agreements. No official contracts were signed, pending an election to determine a bargaining group for workmen.

PERSPECTIVE . . . .

Union Shop Elections

A caravan of 23 election crews riding in automobiles and trailers moved across western Pennsylvania May 10, as the National Labor Relations Board conducted its first union-shop election for the construction industry.

The 18,000 to 20,000 employees of some 100 western Pennsylvania contractors who were eligible to vote, registered their opinions on one question only—that of authorizing five unions (operating engineers, hodcarriers, teamsters, carpenters and pile drivers) to negotiate union-shop contracts with employers. Actually, these unions some months ago signed new contracts with the Construction Association of Western Pennsylvania (an AGC chapter) containing a union-shop contract with the proviso that it would become effective if approved by workers at an NLRB election to be held at some future time.

NLRB set up the election procedure with the aim of providing a pilot test for similar elections in 12 other areas. The problem of how to conduct such balloting in the ever-shifting, seasonal, construction industry has long vexed the government agency (*ENR* Jan. 8, vol. p. 26).

But even as labor board workers toiled to collect and tabulate the votes, observers in Washington said there may never be another election of this type.

Senator Irving M. Ives of New York and Representative Gerald W. Landis of Indiana already have a bill ready for introduction that would amend the Taft-Hartley law to eliminate the union-shop election requirement. The new measure would leave the matter of the union shop to collective bargaining without direct worker authorization, providing only that the union in question is properly certified.

The Ives-Landis move is prompted by the fact that the union-shop elections so far have been almost completely superfluous—the unions have to date won 99 out of 100 such elections, with the union-shop being approved by about 85 percent of the total number of workers voting. And because of the union-shop election requirement of the law, NLRB is being swamped by requests for about 5,000 elections a month.

An even more drastic change has been advocated by Sen. Joseph H. Ball of Minnesota—chairman of the joint committee watch-dogging the Taft-Hartley Act—who has proposed reviving a bill he introduced some time ago banning any form of compulsory union membership.

Senator Ball's Senate-House committee will begin hearings on these matters on May 24.

States report increase in highway activity

Survey, new construction and repairs are under way in various sections

With the approach of heavy summer automobile travel, most states last week had announced progress in their extensive highway rehabilitation programs. Among reports were:

Indiana—The Indiana State Highway Commission has more than $6,317,000 in highway maintenance contracts under way, covering repair of more than 380 miles of roads damaged by weather and by heavy truck and bus traffic. State police have stepped up truck-weight checking activity as one means of protecting highways.

Arizona—An additional $400,000 for construction of the Globe-Miami highway has been allocated by the state highway commission, bringing funds earmarked for the project to $800,000. The additional money was transferred to the Globe-Miami fund after the Phoenix motor freeway project was allowed to lapse.

Ohio—A move to test the constitutionality of state legislation limiting uses to which Ohio cities may put gasoline tax money has been launched by Mayor James A. Rhodes of Columbus. He suggested an ordinance appropriating approximately $150,000 of these funds for construction of a new engineering center. Since the legislature limits city uses of gas tax money to street construction, maintenance and signs, Mayor Rhodes said the ordinance will give opportunity to bring the matter to the Ohio Supreme Court.

Delaware—Road construction projects totaling $1,180,000 are soon to begin in Delaware it has been announced by William A. McWilliams, chief engineer. The highway department is advertising for bids on three contracts for projects in lower Delaware.

North Carolina—Contracts of more than $500,000 have been let by the State Highway Commission for the first phases of the construction of a cross-town boulevard at Charlotte, to relocate U. S. Highway 74 through that city. The contracts went to the Blythe Brothers Construction Co. of Charlotte, which bid $459,899 on the roadway and $70,064 on the structures.

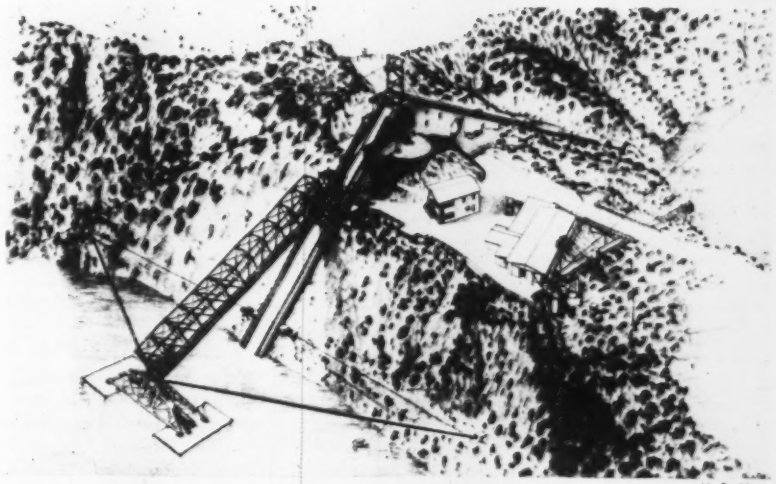
Oregon—An agreement has been reached between the Oregon state highway commission and Marion and Polk counties for financing construction of a bridge across the Willamette River at Independence. The state will pay half the cost and the counties 25 percent each. After construction the 2,214-ft. bridge will be turned over to the counties for maintenance. It will be built by the Macco Construction Co., Clearwater, Calif., whose bid was $845,900.

Virginia—Work is to begin soon on the B. F. Buchanan Memorial highway, a long-anticipated project which is regarded as one of the most difficult problems yet to be undertaken by Virginia's road builders. When the road is completed Marion and Tazewell will be only some 30 miles apart by highway as against the present 60 miles.

Minnesota—The St. Paul city council has voted to award the 1948 blanket sidewalk contract to the Standard Stone Co. With necessary municipal engineering and office costs added, the sidewalk work this summer under this contract will cost $1.96 per running foot of 6-ft. sidewalk, or $78.40 for a 40-ft. lot. Last summer the price was $1.71, or $68.40 on a 40-ft. lot.

In 1940, the running-foot figure was 95 cents, or $38 on a 40-foot lot.

Kentucky—A movement has started to sponsor construction of an alternate U.S. Route 60 that would bring more transcontinental traffic through Paducah and other parts of the state. Harry O. Glasser, president of the U. S. 60 National Highway Association, says Kentucky is an important link in U. S. 60 which runs from Virginia Beach, Va., to Los Angeles, Calif., but the traffic is being diverted north from it at Louisville because of the winding route of U. S. 60 along the Ohio River.



U. S. Navy

VARIABLE-ANGLE TORPEDO LAUNCHER—What is said to be the largest all-welded span in existence is incorporated in this variable-angle torpedo launcher built by the U. S. Navy for experimental use at Morris Dam lake, California.

Navy builds largest all-welded truss

A variable-angle torpedo launcher, which is said to contain the largest all-welded truss ever built, goes into service for the Navy this month on the shore of the 8-mile lake behind Morris Dam, 20 miles from Pasadena, Calif.

To vary the angle of six launching tubes, the steel truss span, 300 ft. long, is hinged at both ends and can be rotated in a vertical plane about the lower hinge. At its upper end, this movable bridge is connected to a wheel-mounted tower carriage, traveling on the steel rails of a sharply pitched concrete ramp. The lower end rests on a floating steel bent supported by two barges.

Vertical height of the concrete incline is about 250 ft. It forms the lakeside leg of an inverted V, with a similar ramp on the opposite side of the hill carrying a 390-ton counterweight to assist in raising and lowering the movable truss span.

Torpedo launching tests have been under way at Morris Dam since 1943 to study the effects of releasing the underwater missiles from high-speed planes. More than 3,000 missiles have been launched in that time from a 300-ft. fixed-angle compressed-air launching tube. Naval Ordnance will greatly enlarge these tests with the aid of the new variable-angle launcher to improve the design of aerial torpedoes.

Cost of the launcher is nearly $2,000,000. The Naval Ordnance Test Station in the Pasadena area designed the entire installation, with J. H. Jennison in charge of the design of the welded span. An overall contract for construction was awarded to the General Tire and Rubber Co. The United Concrete Pipe Corp., Baldwin Park, Calif., erected and welded the 300-ft. steel truss span.

Biological warfare hazards assayed

(*Continued from page 53*)

"Many of you may have wondered what was being done to safeguard surface or underground sources of public water supplies from contamination by radioactive and toxic wastes from atomic energy plants. You will be most favorably impressed when the facts are made known.

"The effect of radioactive wastes on various organisms—of special interest to sanitary engineers because of their use in water purification and sewage treatment—is under observation and very shortly will be a subject of extensive research."

It was pointed out by Mr. Gorman that these wastes are radioactive in various degrees and for different periods of time ranging from a single second to thousands of years. Some of them are highly toxic. They are of such a character that disposal into the air, to the soil or into watercourses without proper pretreatment would constitute a public-health hazard.

National policy on water resources

Addressing himself to the question: "What should be the position of the American Water Works Association on national water policy?", Abel Wolman, professor of sanitary engineering at The Johns Hopkins University and chairman of the association's committee to draft such a statement, reported that "the question is far simpler than any conceivable answer might be".

Faced with a "riches" of competitive beliefs, desires, and panaceas, said Dr. Wolman, the committee determined that its most useful contribution to the association would be to present certain general principles that might serve as a guide.

"The traditional practice of approaching flood control, pollution abatement, industrial and domestic water use, navigation, waterpower, irrigation, fisheries, and recreation as distinct and separate problems," he continued, "has led to wasteful expenditures."

Out of the ingredients of conflict, said the committee, it was possible to reach agreement on these major elements of a national water policy:

1) Provide that first priority for water resources development be afforded to beneficial consumptive use, present or future, of water for domestic, municipal, stock water, irrigation or general agricultural purposes;

2) Provide for the preparation of plans for the unified regulation and development of the river systems of the country, upon sound engineering and economic principles;

3) Provide for definite and effective programs for construction of the projects included in such plans, the programs to be prosecuted as found desirable by Congress to meet necessities;

4) Provide that programs be made adjustable on a federal level to the exigencies of unemployment relief in periods of business depression and of defense in times of danger.

5) Take proper account of economic, special, and existing benefits, in considering specific projects;

6) Limit federal contributions toward projects to amounts warranted by all the national interests involved;

7) Provide in so far as practicable equitable distribution of project costs;

8) Assist in the settlement of controversies between or among states over interstate waters;

9) Provide for systematic and effective cooperation among federal agencies and between such agencies, and agencies and individuals in formulating water plans and programs; and

10) Eliminate inconsistencies and conflicts between or among existing laws and regulations relating to the control or utilization of water resources.

Geological Survey supported

The association's board also put itself on record as being opposed to any curtailment of the groundwater studies of the U. S. Geological Survey. This move was taken because private well drillers in some parts of the country have been charging that the USGS was using federal funds to drill wells for municipalities in competition with private enterprise. Congressional interest has been aroused to cut the funds requested by the agency.

While agreeing that the USGS activities should be expanded to hasten and improve the collection of information on water resources, the association held to the opinion that neither should this agency nor any of the state agencies with which it cooperates own or operate test-well drilling equipment if competent private drillers are available.

Some of the liveliest discussion at the meeting had to do with the use of sulphur jointing compounds. Extracts from this and other papers will appear in a later issue.

ON THE RECORD OF THE AWWA MEETING

Aside from the highlight news developments at the 68th annual convention of the American Water Works Association appearing on page 1 of this issue, here are some of the other noteworthy matters of record:

***New Officers*—President: Linn H. Enslow, Editor, *Water and Sewage Works*, New York City; Vice-president: A. P. Black, professor of chemistry, University of Florida, Gainesville; Treasurer: William W. Brush, Editor, *Water Works Engineering*, New York City.**

***Awards*—The John M. Diven medal for outstanding service to Clinton Decker, sanitary engineer for the Tennessee Coal Iron and Railroad Co., Birmingham. The John M. Goodell prize (a cash award sponsored by *Engineering News-Record*) for the most notable paper, to Melvin P. Hatcher, director of the Kansas City (Mo.) Water Department.**

***Honorary Memberships* — Charles P. Hoover, chemist, filtration plant, Columbus, Ohio; Louis R. Howson, consulting engineer, Chicago, Ill; and Abel Wolman, professor of sanitary engineering, The Johns Hopkins University, Baltimore, Md.**

***Attendance Record* — With a total registration of 1,704, attendance exceeded all previous records, including that at San Francisco last year where the number was 1,546.**

***Exhibits*—82 manufacturers displayed their products. Many of them reported buying interest high.**

Water manufacturers see good business

Members of the Water and Sewage Works Manufacturers Association meeting in Atlantic City last week were cheered by these predictions: (1) Business in general will carry on somewhere near its present volume for another year; (2) there is good expectation of a continuing high level of business during the next few years; and (3) there will be no war.

The bearer of these good tidings was Dexter M. Keezer, director of the department of economics, McGraw-Hill Publishing Co., Inc. In an analysis of the business situation Dr. Keezer said that while volume would remain high, he also anticipated that inflationary pressures would continue resulting in an increase of 5% in prices by the first of the year.

Optimism for the long-range view was based "primarily on the purchases of the sixty million people gainfully employed here at home as the backbone and most of the substance of continued prosperity". The economist ventured the opinion that there will be no war for 10 years.

U.S. Public Health Service programs nation-wide aid for pollution control

Official discloses plan for 14 river-basin offices to offer technical help to state pollution control bodies

The U. S. Public Health Service has plans ready for a nation-wide program of technical assistance to the states in stream pollution control. The over-all plan, designed to furnish technical help on a regional basis, contemplates eventual establishment of staff offices in 14 river-basin areas.

First announcement of the new program was made at the recent quarterly meeting of the Interstate Commission on the Potomac River Basin in Harrisburg, Pa. (*ENR* May 6, vol. p. 676). Carl E. Schwob of USPHS—the man who will head the new water pollution control program—told the meeting that river-basin offices would be purely to serve the states and would take over no state prerogatives.

Accomplishment of the full program would depend on Congressional approval of a stream pollution control bill like the one now being considered. Even without such action, however, the health service faces the necessity of going ahead with the establishment of offices in basin areas to carry out the duties assigned to it by current law.

No matter what Congress does at this session, the program will have to move gradually. Personnel to staff the offices will be a major problem. The river-basin engineer in charge of each office should be a man with state experience and the ability to act cooperatively. Commitments so far obtained from men of this caliber would limit the initial quota of offices to four or five.

Offices to be autonomous

Offices in the river-basin areas would be autonomous, with the engineer in charge of each office holding full discretionary authority for his own territory. His staff, according to the plan, would consist at the start of a biologist, a draftsman, and clerical help, and, in the larger basin areas, one or two additional engineers.

Each office would function as the technical arm of a river-basin water pollution control board, made up of representatives from the state water pollution control authorities of all the states in the area. The board would recommend the overall control program for the entire basin, with full consideration of water use in each stream as it affects industry, agriculture, domestic and industrial water supply, fish and aquatic life, and recreation. Pollution standards for each stream would be determined by the board in accordance with its decision on appropriate water use of that stream.

One of the board's prerogatives would be to set up a priority system for the basin, indicating where pollution abatement efforts should be expended—and in what order. If Congress authorizes financial aid for control works, the federal funds could be apportioned in accordance with this system.

As agent for the board in his area, the river-basin engineer would be responsible for cataloging the streams and tributaries, assembling all needed information, and setting up a pollution control blueprint for the watershed. At the request of the board, or of state and inter-state agencies in his territory, he would make surveys, investigations and studies of pollution problems.

Research work would be referred to the Cincinnati laboratories of the USPHS, and these laboratories also would supply technically trained specialists to answer problems beyond the scope of the basin office. State health and pollution agencies could send men to the laboratories for training. Pending legislation (the pollution control bill) authorizes funds to enlarge the Cincinnati facilities for these purposes.

Eight existing USPHS district offices would be tied into the nation-wide program and would be utilized by the river basin engineers to supplement the technical service of the basin staffs. Mark Hollis, assistant surgeon general and chief of the USPHS Division of Sanitary Engineering, hopes to have a special water pollution adviser in each district office for this work.

River-basin offices are to be set up in logically integrated areas—14 in all—having similar stream pollution conditions. Some of the areas encompass single river systems or watersheds, while others, particularly the coastal and Great Lakes areas, take in several river basins.

List basin areas

Basin areas mapped out by USPHS for pollution abatement offices are: (1) New England, (2) North Atlantic, (3) Middle Atlantic, (4) Southeastern, (5) Ohio-Tennessee rivers, (6) Great Lakes, (7) Upper Mississippi-Red River of The North, (8) Missouri River, (9) Southwestern-Lower Mississippi, (10) Western Gulf, (11) Colorado River, (12) Great Basin, (13) California, and (14) Pacific Northwest.

Washington headquarters of the USPHS would coordinate policies of basin areas which adjoin one another, particularly where watersheds discharge into a common stem, and would furnish the money for operating the basin area offices. Otherwise, the central office would avoid interfering with autonomous operation of the basin areas.

One of the basin offices already is in existence. To service and coordinate pollution control in the development of the Missouri River Basin, an office has been functioning in that area for the last year, financed by funds from the Army engineers, the Bureau of Reclamation and the basin states.

SPEEDY FACTORY—Adherence to a specially-arranged construction schedule has made possible partial operations in the new L. A. Dreyfus Co. gutta-percha compounds plant near Plainfield, N. J., two months ahead of final completion date. The plant consists of a fireproof factory, administration, warehouse and boiler house structures, and a 100,000-gal. water storage tank. An elaborate waste water treatment system, a network of concrete roads and a large macadam parking area have been provided. The 400x700-ft. factory is a 1-story, monitor-type structure with a continuous glass-block band in the upper part of the exterior walls. Engineers and contractors are Wigton-Abbott Corp., Plainfield.

Panama sea level canal seen unsound

Harry O. Cole, former engineer on the construction of the locks at the Pacific end of the Panama Canal, told the annual meeting of the Panama Canal Societies of the United States in Washington, D. C., recently that the plan proposed for converting the lock canal at Panama to a sea level type is unsound and wasteful.

He criticized the plans as "fatally deficient" and said they "were made without the advice of those who have first-hand knowledge of the difficulties and hazards encountered in building the present canal."

Mr. Cole recommends building a single new flight of three locks at the Pacific end to replace the two-flight locks at Miraflores and the single lock at Pedro Miguel. A basic part of this plan is creation of a large terminal lake above the locks and between them and the entrance to Gaillard Cut. He would also build a new set of locks at the Atlantic end.

Mr. Cole presented these general comments in the course of a commemoration address honoring the late Sydney B. Williamson, engineer in charge of the Pacific locks construction from 1908 to 1912. During this period Mr. Cole was his assistant and thereafter, until 1914, his successor.

In expanding his views later, Mr. Cole attacked the contention that a sea level canal is required because of its greater safety from atomic bomb attack. "With the rapid increase in tempo of invention, particularly in radar control of aiming, directing and long distance delivery of powerful, destructive bombs," he said, "who is there to say that any canal, lock or sea level, can be made safe or secure from destruction." Pointing out that 30 miles of long earthern barrier dams are required to intercept and divert the Chagres and other smaller rivers from the sea level canal, he foresaw the possibility of some of these dams being ruptured by bombs, flooding sections of the sea level canal, filling them with mud and rock and "putting shipping out of business for months." A similar menace is posed by floods, stated Mr. Cole, citing flows as great as 300,000 cu. ft. per sec. into Gatun Lake during the great flood of 1923.

Fog hazard

The sea level canal would also, in Mr. Cole's opinion, create a "fog canyon" in and beyond the deepened Gaillard Cut, which would delay shipping far more than present fogs do in the lock canal. He also believes that the tidal current of 5 to 6 miles an hour through the cut would be detrimental to shipping. Finally, to convert the lock canal to sea level, and at the same time to maintain uninterrupted traffic through it during the long construction period "would be the next thing to human impossibility." The sea level report had indicated that a construction procedure could be used that would require only seven days stoppage of shipping during the conversion.

In urging improvement of the present lock canal, in lieu of a sea level conversion, Mr. Cole recommends building a new and modern set of locks in flight southwest of the present Miraflores locks, taking advantage in so far as possible of excavation already made under the prewar Third Locks Project. Corollary work would involve building dams and spillways to raise the present 54-ft. level of Miraflores Lake to the 85-ft. level of Gaillard Cut and Gatun Lake; at the same time removing entirely the present Pedro Miguel lock structures and converting Miraflores Lake into a large Pacific terminal basin. He also contemplates the necessity of making improvements in the alignment of the canal channel between Gamboa and Gatun and of building additional modern locks on the Atlantic end, probably in the location proposed under the Third Lock Project.

With this method of improvement there would be brought about, in Mr. Cole's contention, a reduction of the present shipping hazards caused by fog and by bank suction and surges in Gaillard Cut resulting from drawing water for the Pedro Miguel locks. It would also speed up shipping by removing the bottleneck at the Pedro Miguel lock. He estimates that the work would cost from 500 to 700 million dollars, depending upon the amount of improvement in canal alignment, and that the construction time required would be from five to six years. He contrasted this with his belief that conversion of the lock canal to sea level would cost anywhere from 2½ to 3 billion dollars and require perhaps 20 years.

New contracts are let for Newark, N. J. VA. hospital

The New York district office of the Corps of Engineers said last week it had awarded a $13,954,000 contract to the H. R. H. Construction Co., New York for the construction of the 16-story, 1000-bed Veterans Hospital to be built on a 35-acre site in Newark, East Orange and South Orange, N. J. Included in the contract is the construction of the boiler house, laundry and main garage.

Two previous contracts awarded were for the excavation and foundations.

Senate approves new science measure

The Senate last week passed and sent to the House a new National Science Foundation bill (S. 2385) that definitely establishes the lines of executive responsibility under the President. To the extent that the measure accomplishes this purpose while at the same time keeping the foundation clear of political interference, the bill as it stands is believed to have a good chance of enactment.

President Truman last year vetoed a predecessor bill (S. 526), principally because it gave the President no direct control over the foundation's director, the chief executive officer of the proposed establishment (*ENR* Sept. 4, 1947, vol. p. 306). In the new bill, the President appoints the director and has the power to remove him for cause.

In its broad outlines, the bill aims for the same objectives as last year's measure—coordination and stimulation of basic research and education in the sciences, on a national basis. The bill uses much of the same language as the older version. Changes are directed mainly to streamlining the foundation organization and nailing down the executive responsibility.

As for the director, the President cannot nominate him until after all foundation members have been confirmed and are in office. This plan is expected by its Senate sponsors to give the foundation's policy-making group an opportunity to tell the President what kind of director it wants before he submits a nomination to the Senate.

So far as possible, the bill avoids hampering the foundation by limitations, geographical or otherwise, in making contracts, loans or grants for basic scientific research and in granting scholarship or fellowships. It merely directs the foundation to avoid undue concentration of these research and educational activities.

As before, the bill directs the foundation to carry on its research and educational work through existing organizations, agencies, institutions or individuals, governmental or private.

OBITUARY

Embury A. Hitchcock, 81, dean emeritus of the college of engineering at Ohio State University, Columbus, Ohio, died April 29 in that city. From 1893 until 1912 he was on the faculty at Ohio State. He resigned in 1912, but returned as dean in 1920.

W. A. Fallows, 64, minister of public works for Alberta, died in Edmonton, Alta., May 3. For the last 13 years he directed the extensive provincial paving program.

Alban Janin, 67, civil engineer and president of A. Janin and Co., Ltd., builder of the new Canadian National Railway central station at Montreal, Que., and many other important Canadian buildings, died on April 25.

Monroe F. Rubin, 64, Cleveland, Ohio, contractor, head of the Bass Construction Co., once one of Cleveland's largest structural steel contracting firms, died May 3 in an automobile accident near Ashland, Ohio.

Jacob Shapiro, 59, West Stamford, Conn., president of the M. Shapiro and Sons Construction Co., New York and Louisville, Ky., was killed May 2 in an airplane crash at the Danbury, Conn., airport. He was piloting the plane.

Octave S. Payzant, formerly on the engineering staff of the New York Central Railroad and later a consulting engineer, died at Buzzard's Bay, Mass., April 27.

Gaspard Archambault, 60, civil engineer and contractor died in Montreal, Que., May 2. He had been an engineer for Montreal and also with the Dominion Bridge Co.

Adolph W. Ehlers, 62, engineer and retired Army major, died May 4, in Pasadena, Calif. A veteran of both wars, he lived in Temple City, near Pasadena, and was one of the first members of the Los Angeles County building department. He also operated an engineering firm in La Habra.

William M. Jonson, 62, retired Los Angeles civil engineer, died April 27. He was a graduate of California Institute of Technology.

Charles W. Wiley, 82, retired engineer, died April 29 in Los Angeles, Calif. He developed water wells for various Southern California cities.

Engineered house costs reduced, report shows

A preliminary report on time-studies on erection of the industry-engineered house performed at the University of Illinois points to possible major savings in home-construction costs through application of some new techniques and careful attention to the elimination of time-consuming details.

A report of the experiments submitted to sponsoring agencies by James T. Lendrum, associate coordinator, pointed out as areas of greatest savings the use of a roof truss instead of conventional beams—thus eliminating expensive interior partition wall and floor construction—and considerable preassembly of parts of the structure.

Among the time-saving devices used were the assembly of the exterior wall before tipping the member up into position; pre-assembly of gable-ends on a jig table; installation of interior finish material on walls, ceilings and floors before partitions are erected; preassembled windows, and pre-cutting of door and window trim.

Savings—not as great as those produced by the methods above—were also made by:

Precutting floor joists, preassembling cabinets, and tipping up partitions.

The report details experiences with three wood-frame houses designed on a modular basis. To achieve savings, considerable layout and job supervision and worker training were needed.

The report was prepared for sponsors, which include: the Industrial Research and Development Division, U. S. Office of Technical Services; The Producers' Council; the National Retail Lumber Dealers Association, and the Small Homes Council of the University of Illinois.

MAJOR MEETINGS

Society for Experimental Stress Analysis, The Roosevelt Hotel, Pittsburgh, Pa., May 27-29.

Engineer Institute of Canada, 62nd annual meeting, Banff Springs Hotel, Alberta, June 1-5.

National Conference of Community Planning, annual meeting, Banff Springs Hotel, Banff, Alta., June 2-5.

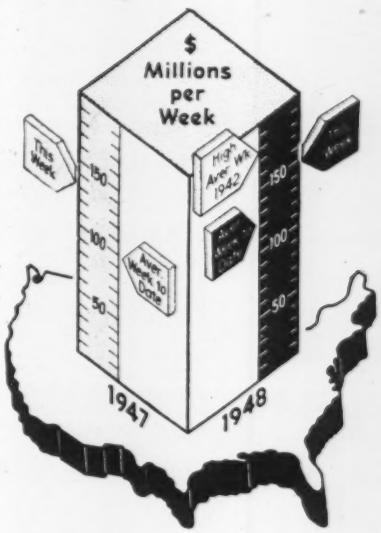
American Society for Engineering Education, 56th annual meeting, University of Texas, Austin, Tex., June 14-18.

National Association of County Officials, Annual conference, Hotel George Washington, Jacksonville, Fla., June 21-23.

American Society for Testing Materials, annual meeting, Hotel Book-Cadillac, Detroit, Mich., June 21-25.

American Society of Civil Engineers, Annual convention, Hotel Olympic, Seattle, Wash., July 21-23.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of May 13 1948	Cumulative 1948 (20 wks.)	Cumulative 1947 (20 wks.)
Federal	$11,529	$439,196	$191,705
State & Mun.	56,640	848,930	582,723
Total Public.	$68,169	$1,288,126	$774,428
Total Private	81,067	1,176,280	1,196,872
U. S. Total..	**$149,236**	**$2,464,406**	**$1,971,300**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (20 wks.)	Cumulative 1947 (20 wks.)
Waterworks ...	$2,828	$64,023	$46,775
Sewerage	1,367	79,264	41,948
Bridges	5,551	106,305	59,629
Highways	28,844	333,522	259,486
Earthwork, Waterways	4,733	221,841	161,911
Buildings, Public	20,572	399,672	187,125
Industrial	27,695	369,181	311,747
Commercial ..	49,995	716,982	696,582
Unclassified	7,651	173,636	266,097

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (20 wks.)	Cumulative 1947 (20 wks.)
NON-FEDERAL	$1,397,945	$618,481
Corporate Securities	768,176	212,654
State and Municipal	629,769	405,827
**Total Capital ..... **	**$1,397,945**	**$618,481**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost*	May '48	447.86	215.29
Building Cost*	May '48	333.93	180.51
Volume	Apr. '48	302	132

*Revised.

EDITORIALS

VOLUME 140 NUMBER 20

May 13, 1948

What Price Cement?

HENCEFORTH the buyer of cement is to pay the price to which he is entitled by law. What that will be is not certain, but it will not be a uniform price from all producers at a given delivery point says the U. S. Supreme Court, for such a pricing practice is illegal. What is certain is that the construction contractor is going to assume a lot of troubles of whose existence he was not aware, such as figuring freight rates, shopping for supplies, comparing mill prices and, in general, worrying over one of his bid items that heretofore has been invariable for a given job and for all his competitors. To top it all off, he may pay more for cement than he did previously. It has been stated in these columns before that uniform prices for a standardized product such as cement are inevitable. The only way they can be otherwise is by eliminating competition. And that will hardly bring prices down. Until Congress in its wisdom clarifies its stand on business pricing practices in general and cement pricing in particular, this Supreme Court decision is going to be hard to live with.

Saginaw-Midland Water Line

UNIFIED ACTION of Saginaw and Midland, Mich., in securing a joint water supply, (ENR April 29, 1948 vol p. 646) is not the first such move in this country. But the $12,000,000 project, by its very size—78 mi. of large concrete pipe whose casting and laying procedures are described in this issue—demonstrates the feasibility of metropolitan areas banding together for securing an improved and dependable water supply. Such action offers opportunity to finance jointly a program too costly for one city to bear alone. Moreover, it permits going long distances, when necessary, to locate a source of supply far removed from the potential hazards of industrial and domestic pollution. Water supplies in many localities are being progressively polluted to the point where they are barely acceptable for treatment under present-day standards, and in other communities supplies are being dangerously overtaxed. To combat these threats, bold planning is needed not only on a long-range basis but also in the spirit of joint cooperation to insure the most dependable supply at the lowest cost.

All The World's The Stage

SO MANY are the financing problems of world recovery and development that the vital role to be played by engineering and construction is often overlooked. And present preoccupation with the Marshall Plan tends further to obscure the fact that continuing and permanent means of world development are companion necessities to the emergency measures now so much in the limelight. Both of these situations are presented in their proper perspective by an article in this issue on the International Bank for Reconstruction and Development, usually known as the World Bank. That engineers are as important to its functioning as bankers is amply made plain. That it represents a permanent financing institution for continuing world development through capital investment is equally clear, and tremendously significant for engineers particularly. Owned and run cooperatively by the nations of the world, it must operate on as sound a lending basis as any commercial or investment bank. In stating that applications for loans that are made to it must be supported by the best and most exhaustive technical studies possible, the bank is opening up new opportunities for engineering practice. And it is opening them on a world-wide stage. The significance of the World Bank should not be missed by civil engineers and construction men.

No Such Shortcut

GOVERNOR DEWEY'S instructions to the Power Authority of the State of New York to begin negotiations looking toward development of the power resources of the international section of the St. Lawrence River jointly with the Hydro-Electric Power Commission of Ontario will help to keep that question alive, but it can do little toward the actual start of construction. That must wait on the signing of an agreement between the two countries. To construe the Boundary Waters Treaty of 1909 as delegating authority for such a major change in the regimen of the St. Lawrence River to the International Joint Commission, as the Governor's advisers have done, is just wishful thinking. And even if the proposal had more substance it seems obvious that Congress would not accept such an invasion of its cherished prerogatives. If Governor Dewey wants to get the power, the place to start is in the U. S. Department of State with a request for a new

agreement with Canada to replace the out-dated 1941 agreement, which Congress refuses to accept.

Military Service and Engineers

BOTH universal military training and a revival of the draft are being actively considered by Congress at the present time. A law giving effect to either, if not carefully planned, could create a serious shortage of engineers and scientists at a time when the nation might need them most. That fact should be impressed on those who will put into final form the legislation now before Congress.

What Congress is dealing with today is not an emergency situation such as existed at the start of World War II. Then the Nation could afford the risk of a temporary interruption in its supply of engineers, scientists, and other specialists, such as physicians and teachers, in order to build a big army quickly. Today, we are merely building up our potential military strength to discourage attack at any time during at least the next decade. Industrial capacity is just as important to that objective as soldiers, possibly more so. Hence, there should be no interruption or reduction in the flow of the engineers and scientists needed to keep our industrial production abreast of expanding demand and to provide the technical advances that are essential to progress.

All signs point to the need for more scientists, more engineers, more industrialist leaders with a scientific background, and more men in public health work with a sanitary engineering background. Consequently, if the flow of such men from our colleges and universities is to continue unchecked, the flow of men into those schools must not be interrupted.

Deferment of students in or about to enter scientific and engineering schools is not the proper answer, although it may be found desirable in the early stages of any program for increasing our military forces. The answer appears to lie in the early inauguration of a scientific system of selecting students for professional schools to replace, at least temporarily, the present haphazard system.

One means of accomplishing this would be to require that all young men called up for their preliminary physical examination for military service be required to take one of the tests that now are available to determine aptitudes for scientific work. For those men already in college, those who pass with high marks should be continued in school and the remainder should be sent to camp when their time comes. Out of those not in college or ready to enter, those who rate high in the scientific-aptitude tests should be classified for scientific training and put in a pool from which men are to be drawn to replace men taken from the schools or men who graduate. Some of the prospective students can, of course, be given basic military training before they are sent to the scientific schools.

Such a plan would maintain a steady flow of well qualified young men into our scientific schools. Obviously, the government would have to finance such a training program just as it is now doing on a smaller scale under the GI Bill of Rights. Many of the men so trained would go to the military forces to supply its large need for men of scientific ability, others would go into government research and still others into industry. The two latter groups, however, might be continued in some sort of a military reserve.

A plan of this kind would not be as radical a departure from traditional educational practices as would appear at first glance. This nation now provides free education through high school. The proposed plan would extend free higher education to a limited number of qualified students as a part of a program for meeting a national emergency. A similar plan already is embodied in the National Science Foundation bills now before Congress. Its justification there is assurance of an adequate supply of trained scientific men for future peacetime needs. If preparation for defense against military attack must now be superimposed on normal requirements, then the greater need can only be met by more drastic—and more costly—measures. That fact must be faced.

Integrating military training with advanced scholastic training will not be easy. It may call for a reorientation of schedules in schools of higher learning and possibly in our secondary schools. But it can be done, and if the colleges know that they will be assured of a steady flow of selected students, their replanning can be carried out with a confidence that is entirely lacking today.

ENGINEERING NEWS-RECORD
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Fig. 1. Built from a trestle by means of a rail-mounted gantry, the twin lines were made of precast reinforced concrete pipe.

Twin Lines Supply Steam Plant Water

Contents in Brief—Two 10-ft. dia. pipe lines extending 2,000 ft. into the ocean serve as condensing water intake and discharge lines for the new Redondo Steam Station of the Southern California Edison Co. This dual system will permit reversal of flow so that heat shock from the warmed discharge water together with chlorine dosage will inhibit marine growth in the lines. Hydraulic and construction problems are discussed.

TO PERMIT reversal of flow in intake and discharge lines supplying condensing water for the new Redondo steam station of the Southern California Edison Co., two 10-ft. dia. pipe lines were built about 2,000 ft. into the ocean off the southern California coast. By such reversal, marine growths in the lines are expected to be inhibited because of the heat shock of the warmed condenser discharge water and because chlorine dosage is possible at the land end of the lines. The 12,000-kw. plant will supply power to the southern California area. Structural details were given in *ENR* March 18, vol. p. 430.

Conditions prevailing for construction of offshore pipelines in the southern California area differ from those usually encountered primarily because of the flat slope of the ocean bottom. Other such pipelines recently constructed in this area have, after passing through the surf, been laid directly on the ocean bottom. Because these lines carry sewage, much attention has been given to preventing leaks at joints. This has required special joint design and use of heavy sections.

In contrast to this, at Redondo, comparatively light pipe sections were used and the joints were required to be sandtight but not necessarily watertight. As the pipe was laid in a trench with a minimum of 4 ft. of cover, joints of the type used on ordinary backfilled concrete-pipe construction work were permitted.

End at 30-ft. depth

Because of the gradual slope of the ocean floor, the depth at the end of the lines is only some 30 ft. However, this is enough to permit thorough dispersion of the warm effluent. Besides this, by getting the intake out some distance from the surf where a sufficient depth can be obtained, there is some assurance that sand or other matter in suspension will not present problems.

The two lines are parallel and located 16 ft. center to center for most of their length with manholes at about 250-ft. intervals. The shorter line is nearly straight and is only 1,820 ft. long. Some 100 ft. from the end of this shorter line, the other line starts on a 250-ft. radius curve away from the shorter line until the termini are 200 ft. apart. This arrangement permits best advantage to be taken of existing ocean currents and little direct water recirculation is anticipated.

The lines terminate in inlet and outlet chambers consisting of 14-ft. dia. concrete cylinders on end with the top about 10 ft. above the ocean floor level. The bottom of each cylinder is of caisson-like construction and is well anchored with tremie concrete. No grating or other cover is provided at the inlet but provisions are made for such an installation

should kelp or other large floating matter prove a problem.

The chlorination installation to treat the average flow of 400 cfs. is of very large size, some six automatic chlorinators of 6,000-lb.-per-day capacity being installed. Some chlorine is added to the incoming water to control slime in the condensers. This dose is mild because heavy concentrations over a long period may cause corrosion.

Chlorine treatment for effluent

The remainder of the chlorination capacity will be used to treat the effluent water to aid in keeping the lines clean. It is believed that such chlorine treatment together with the heat shock (condensers will add an average of 18 deg. F. to the water temperature) will inhibit the growth of marine organisms of the crustacean and mollusk classes. Such organisms could easily become established in an inlet line and impair the hydraulic efficiency of the line, thus necessitating periodical shutdowns for scraping purposes. By alternating flow so that a line is alternately used as an inlet and a discharge line, the lines can be treated with chlorine from the land end and, it is believed, costly shutdown for maintenance purposes will be obviated.

Exact tunnel reversion operating procedure has not yet been determined. It may be necessary to reverse flow as often as every 12 hours during the active growing season of certain marine organisms. This time interval will be worked out on the basis of operating experience, but it will be on the conservative side as it is a lot simpler to reverse the flow more frequently than it is to clean the conduits manually.

To prevent serious water hammer and the danger of pump suctions going dry, gates for reversing the flow will be opened and closed over a 4-min. period. As is shown in the accompanying sketch, gates 1 and 3 will be closed and simultaneously gates 2 and 4 will be open. The accompanying chart also shows the effect of such gate movement on water level in the transfer basin (the chamber through which water to be discharged passes) and the pump intake basin. Also shown is the calculated temperature rise of the condensing water.

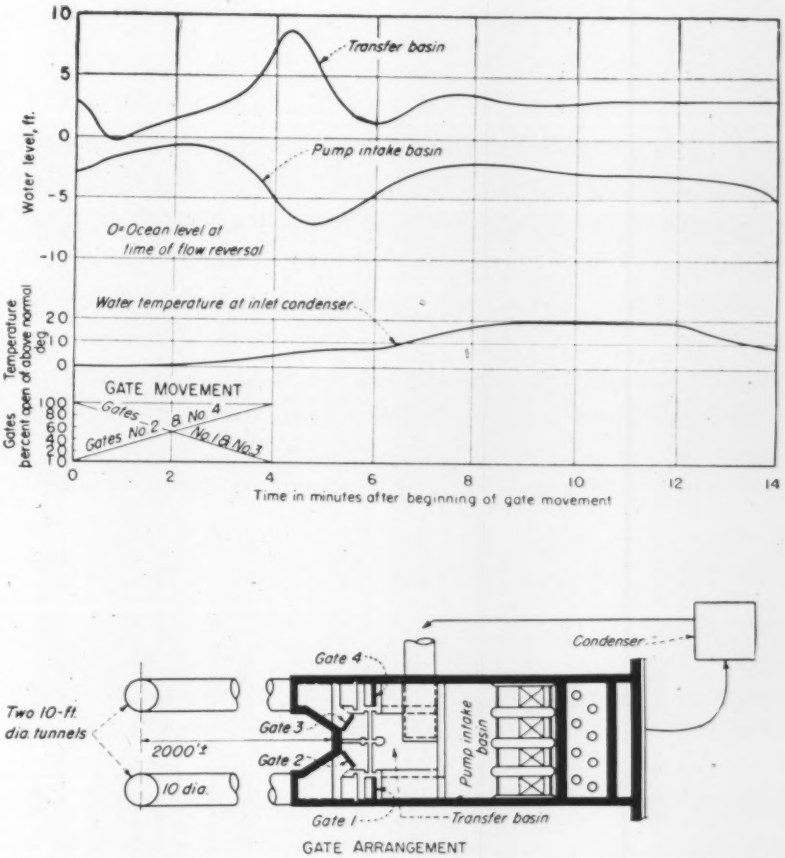


Fig. 2. Because of the time required to arrest the inertia of the water flowing in a line and reverse the flow, careful calculations were made to check the size of the pump intake basin and transfer basin. Two gates open and two gates close simultaneously, thus preventing serious water hammer.

This chart was prepared to check the size of transfer basin and pump intake basin. Because there is of necessity a drawdown of significant quantity in these basins during the reversal procedure, it was imperative that chambers of adequate size be constructed. The chart is based on the following conditions: Circulating water flowing at the rate of 400 cfs., heat transfer of 480,000 B.t.u. per sec., Williams and Hazen constant of 100, transfer basin water surface area of 1,000 sq.ft., pump intake basin water surface area of 3,000 sq.ft., transfer gates 7 x 10 ft., and an operating period of 4 min.

Trestle pier for construction

To place the pipe, a trestle pier was built, which has bents spaced 19 ft. apart and is divided into two bays, each 16 ft. wide. Three rails were mounted on the trestle, one at each edge and one in the center. Thus, construction equipment can operate on rails over each bay, with the central rail common to both bays.

Operating on these rails were a gantry for carrying and placing the pipe and two cranes equipped with clamshell buckets. On the inshore end, a transfer section permits equipment to be switched from one bay to another.

Continuous steel sheetpiling was driven at each side of the trestle for the first 700 ft. of its length. This sheetpiling protected the trenches, which were excavated by cranes operating on the trestle, from being filled too swiftly by the shifting sands of the ocean bottom. When the pipe laying work was done, the sheetpiling was reclaimed.

Beyond the first 700 ft., the grade line was deeper and the surf effects were not as pronounced. Hence, the portion in deeper water was excavated in open cut with no protection. The trenches were overexcavated some 2 or 3 ft. as sand would fill in

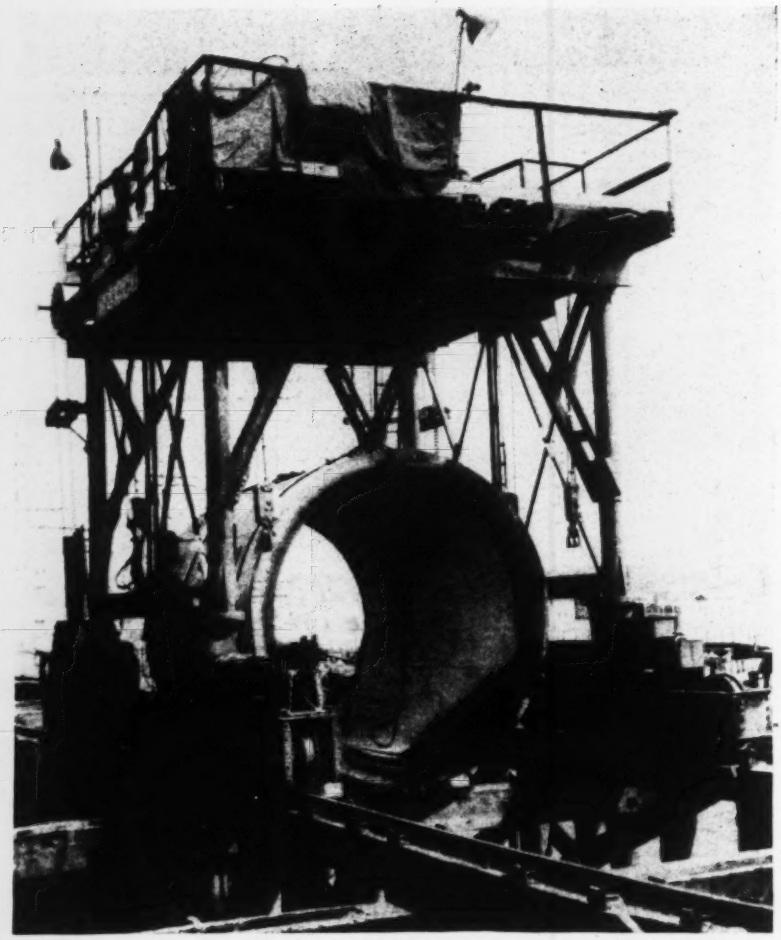


Fig. 3. This gantry was the key to the construction work. It picked up the pipe lengths on shore, carried them to correct position, and lowered and positioned them.

Fig. 4. To hold the pipe in place until the trench was backfilled, shop-built underwater jacks were used. Designed to be easily installed by a diver, they were left in place.

that much before the pipe sections could be placed, even though excavation was kept ahead of pipe laying.

Once the trench was at proper depth, a pipe section was lowered into approximate position. Soundings were taken to get vertical and horizontal alignment as divers could not see clearly enough in the water. A sling around the pipe section was connected to a winch on shore and a 30-ton pull was required to overcome friction in the joints and seat the pipe.

After the pipe sections were placed and their alignment accurately checked, a diver placed a series of clamp-type jacks (two on each side of each section) to hold the pipe until the trench was backfilled. These jacks were fabricated in the contractor's shops and were specially designed for ease in placing under water where movement is restricted and visibility is practically zero. One end fits around a pile in the trestle and the other end is flat so it can be placed against the side of the pipe. No special efforts were made to backfill the trench as currents and littoral drift deposited enough sand for this purpose.

Progress of the pipe placing depended on tide and wind. During heavy seas it was practically impossible to place any pipe. Maximum progress was three pipe lengths in one 24-hour work day and fifteen in a 7-day week.

Intake and outlet chambers

Gunite was used to cast sections for inlet and outlet chambers at the ocean end of the circulating water lines. These two chambers are cylindrical towers, 14 ft. inside diameter and 40 ft. high with walls 18 in. thick. Each was cast in seven sections to be held together by bronze plates, bolts, and straps.

Because of the massiveness of the tower sections, they were cast at the water's edge where they could be loaded on barges with little difficulty. Gunite was used for this work chiefly due to anticipated difficulty in pouring concrete through the heavy reinforcement of the thick walls. The portable character of the gunite equipment also was a factor in its favor due to the temporary nature of the casting yard.

Guniting was done in two stages.

For most sections the inside forms and inside rings of reinforcing were set and cement mortar shot on these. When the reinforcing bars were covered, the work was stopped and the outside reinforcing rings were set in place. The second stage of guniting covered these bars and completed the outside of each section. Although there was a lapse of more than 48 hours between the first and second stage no special precautions were taken to insure bond other than the usual roughening of the surface.

Fig. 5 shows guniting being done from the inside against outside forms for the upper section where the towers bell out to 20 ft. inside diameter. This necessitated use of outside forms with gunite shot from the inside.

Installation a problem

After the sections were cast, they were transported to the job and placed on the floor of the ocean by a derrick barge and were placed in final position by a crane on the trestle used to build the pipe line, pontoons being used to facilitate this operation. The bottom sections were tapered to a relatively thin edge which permitted them to be gradually sunk to place by dredging sand from inside. When each tower had been sunk until its top was 10 ft. above the ocean floor, excavation was stopped and a 5-ft. thick tremie concrete plug was poured in the bottom to serve as an anchor.

W. L. Chadwick is manager of engineering for the Southern California Edison Co. The plant was designed and constructed by the Stone & Webster Engineering Corp., for whom E. A. Dockstader was designing civil engineer, F. S. Clark was western engineering representative, and H. F. Cleary was construction superintendent. Subcontractor for the intake and discharge tunnels was Macco Construction Co., for whom John Sawyer is general superintendent and E. W. Simpson was superintendent. Concrete pipe was supplied by the American Pipe & Constr. Co.

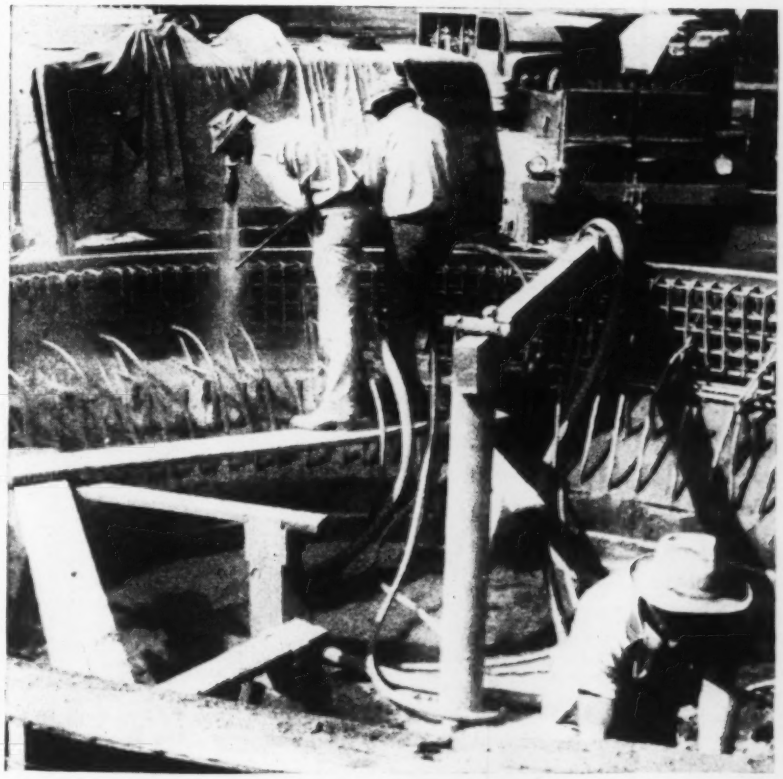


Fig. 5. Gunite shot against one plywood form was used to build up concrete on a heavily reinforced concrete section for the submerged intake and outlet structures. A rotating sweep, shown in the foreground, was employed to keep the sides perpendicular.

Use of Sewer Rentals is Increasing

Popularity of service charges to finance sewage disposal is increasing rapidly in U. S. cities the International City Managers' Assn. reports.

The number of cities over 5,000 population that levy sewer-service charges rose last year from 233 to 432, according to a survey for the 1948 Municipal Yearbook.

More than $20 million was collected by 168 of the reporting cities in 1947, as compared to $13 million collected by 154 cities in 1944. Cleveland, Detroit, Philadelphia and Buffalo—biggest cities levying sewer charges—collected an average of $2.23 million each last year.

Miami, Fla., is among major cities to set up sewer-service charges recently. The charge will go into effect as soon as a new sewage-disposal plant is built. Revenues from the charge will be used in part to pay off construction costs of the plant. Rate will be 75 percent of the water bill.

Louisville, Ky., Akron and Cleveland Heights, O., Brockton, Mass., and Charlotte, N. C. also have adopted sewer-rental charges. Louisville charges amounted to $506,813 during their first five months. Akron collected $625,575 from this source during the first ten months.

Most popular methods of computing sewer charges are basing charge (1) on metered water consumption, (2) on fixed percent of water bill, (3) according to the number of plumbing fixtures per residence, or (4) according to number of sewer connections. Twelve cities reported a combination of methods.

At least 33 cities discount the charge for water used on lawns in summer as this water does not go into sewers. Of the 33 cities making this allowance, 18 use the winter water consumption as the basis for their charge, two cities offer a flat discount in summer months, and another reduces sewer rates in summer.

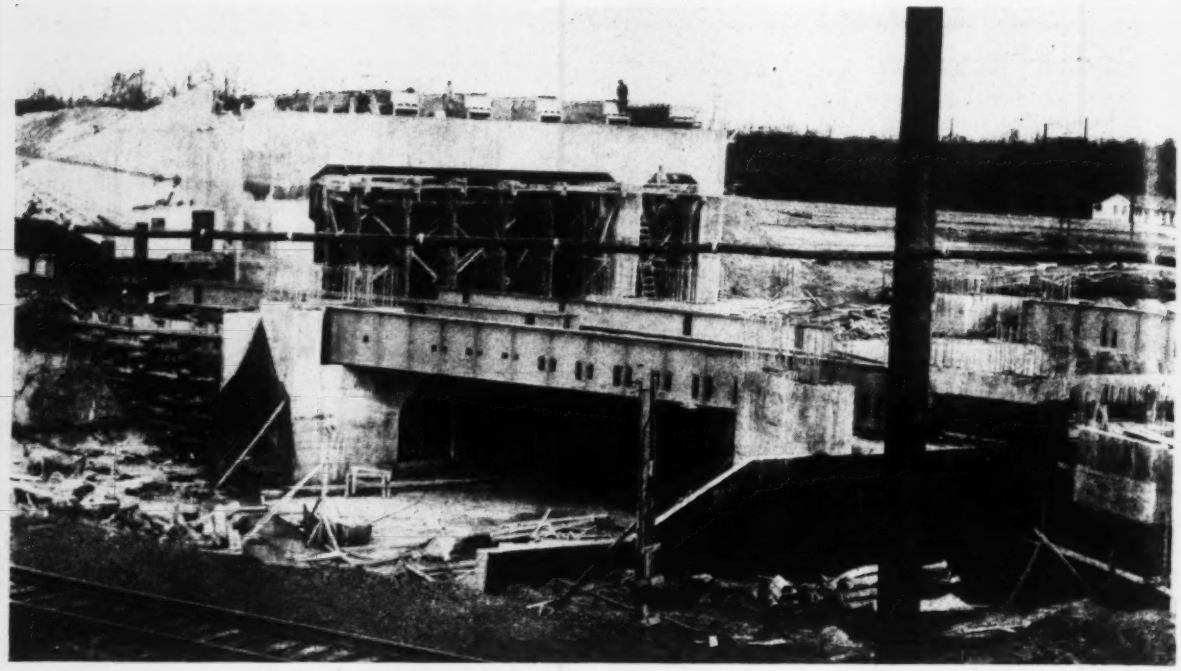


Fig. 1. In constructing the triple-level bridge, the upper level is being built on concrete beams and the double-track railroad on the second level is carried on a 49-ft. steel-girder span. The lowest roadway is supported on timber piles.

Dual-Lane Bypass Road At Norfolk Incorporates Triple-Level Bridge

THIS SUMMER the Virginia Department of Highways expects to place in service the first triple-level bridge it has ever built. The structure will complete a $3,700,000 bypass highway around the city of Norfolk, begun in 1942, which has a total length of 14 miles.

The project called for two 24-ft. portland cement concrete roadways 9 in. thick separated by a median strip normally of 20-ft. width, but reduced to 4 ft. at the bridges. In addition to the triple-level bridge, several special traffic interchanges were required. These included a full cloverleaf to carry the bypass road over Virginia Beach Blvd., which is the first full cloverleaf interchange built in Virginia, a semi-cloverleaf, and a traffic circle. Also required were a long deck bridge over the eastern branch of the Elizabeth River and two overpasses to carry the highway over tracks of the Norfolk Southern R. R.

The paving work has been completed for some time, as have all the major structures except the triple-level bridge. This structure—now well advanced—will cost over $1,000,000. The bypass highway will be on the top level, consisting of two 24-ft. roadways separated by a 5½-ft. median strip and carried on concrete beams.

On the second level are a double-track line of the Norfolk Western R. R. and a 24-ft. roadway to carry one-way vehicular traffic. A 49-ft. steel girder span is used at this level, vehicular traffic being accommodated on a concrete slab and the railroad tracks in a wrought iron trough filled with ballast.

At the lowest level a 46-ft. four-lane roadway is being provided to carry U. S. 460 and State Route 166 under the bypass highway. This roadway, like the abutments, is supported for a distance of 565 ft. on timber piles driven to a close spacing. In all, 1,250 untreated piles and 450 treated piles have been driven for the bridge, the average penetration from 35 to 40 ft.

Automatic pump plant built

Since the lower roadway at the lowest point is 4 ft. below mean sea level, an automatic pumping plant will be installed to assure adequate drainage. A catchbasin is provided at either side of the roadway at the low point and flow from these two basins goes to a central sump for disposal by means of two 4,000-gpm. electrically-driven pumps discharging into a surface drainage ditch.

Before construction of the three-level bridge could be started, a 2,250-ft. detour for the railroad was built, as was a considerable length of detour highway. Unwatering of the construction site was accomplished with a wellpoint system containing 900 ft. of header pipe and 200 wellpoints connected to two 8-in. pumps.

All concrete for the bridge is being

Fig. 2. To carry the bypass highway over Virginia Beach Blvd., or U. S. Route 58, a full cloverleaf interchange was constructed, making it the first built in Virginia.

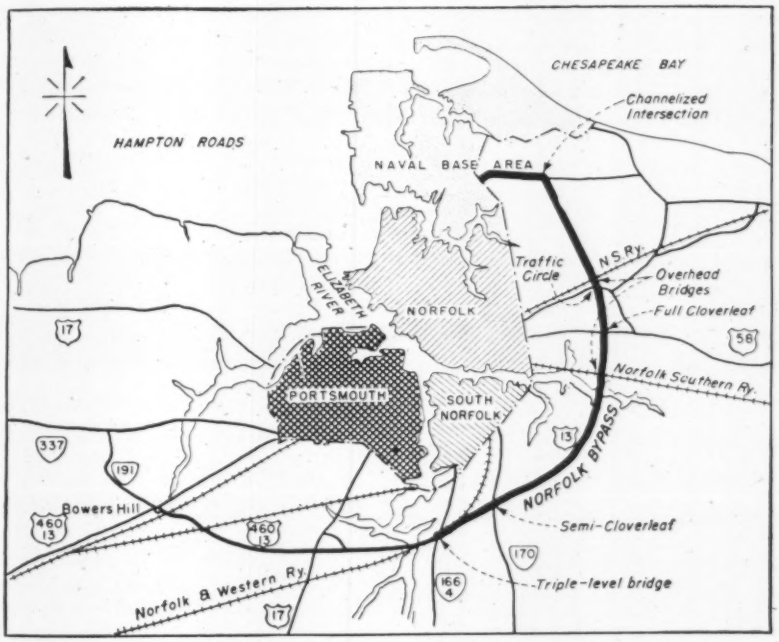


Fig. 3. Bypass highway totals 14 miles in length and extends from the intersection of U. S. Route 460 with State Route 166 at the southern end of the Norfolk Naval operating base in the northern section of Norfolk.

manufactured by a 1-cu. yd. stationary mixer and it is pumped to the forms through a 6-in. dia. line terminating in a length of flexible delivery hose.

General contract for the three-level bridge is held by E. W. Grannis Co., Fayetteville, N. C., and Lewis and Bowman of Norfolk, Va. Major contracts already finished were held by Hechler Bros. Co., Richmond, Va., McDowell and Wood, Roanoke, Va., and by a combination of Ralph E. Mills, W. H. Scott, and Carpenter Construction Co., Norfolk, Va.

C. S. Mullen is chief engineer, and T. F. Loughborough is state construction engineer for the Virginia Department of Highways. Plans were prepared under the direction of A. H. Bell, location and design engineer, and Wm. R. Glidden, bridge engineer. J. M. Hagan, district engineer at Suffolk, supervised construction.

On the early phases of the work, B. P. McWhorter as district engineer represented the Public Roads Administration, which is aiding in the financing of the project, being succeeded at Richmond in 1945 by M. B. Kinnikin.

Volume Change of Marble May Measure Durability

Laboratory studies now under way to determine the basic causes of the weathering of marble may lead to a simple durability test. Experiments under the direction of D. W. Kessler of the National Bureau of Standards building-stone laboratory indicate that the principal destructive force results from temperature cycles that produce a change in volume (*Technical News Bulletin*, National Bureau of Standards, March, 1948):

Old weathered marbles usually show a granulated effect, commonly called "sugaring", which is not confined to the surface but affects the interior of blocks almost as rapidly as the surface. The underlying cause seems to be thermal expansion of the calcite crystals of which marble is mainly composed. Increases in volume, believed due to slippage between crystals, of as much as 60 cu. in. per cu. ft. (3½ percent) have been noted in some weathered samples. Eventually, under repeated cycles of heating and cooling, the bond between the crystals may be completely broken, and crumbling results.

The effects of heating cycles and the changes in volume are being studied at the bureau on a series of marbles to determine if the rates of change for heating cycles can be correlated with observations on the same materials under exposure to the weather. On the basis of observations on weathered structures, the correlations have been satisfactory.

World Bank Operations Rely on Engineering Studies

***Editor's Note**—As consultants to the International Bank for Reconstruction and Development the firm of Madigan-Hyland, consulting engineers of New York, has prepared the accompanying article to acquaint the engineering profession with the bank's purposes, procedures and requirements. Previous published information on the bank has had a financial focus. In this article, it is the basic role of engineering studies in project loan applications that is emphasized.*

IMPORTANT new opportunities for engineers have been opened by the International Bank for Reconstruction and Development, better known simply as the World Bank. The bank itself has recognized the necessity for adequate engineering information in its consideration of project loans, and is emphasizing the importance of submitting complete data to back up applications. Since most of the proposed developments involve construction, heavy equipment and industrial installations of one type or another, it is important for engineers to know of the role they can play, and to understand the procedures which, if properly followed, open up a new field for engineering talent.

Despite its rather formidable name, and a connotation in the word "international" of complicated, high-level governmental dealings, the World Bank is not unlike any normal lending agency with which engineers have long been familiar. Its stockholders, or members, are sovereign governments instead of individuals, but beyond that it is not unlike an ordinary bank, which aims to make loans that will be repaid. The loans in this case have the purpose of reviving and promoting the economies of the member countries, but this introduces no restrictive conditions nor any novelty in banking methods.

The World Bank is just a bank. Its area of operations is world-wide. Its main objective is to facilitate the investment of capital for productive purposes, such as restoring war-disrupted economies or developing the resources of less-advanced countries. Its setup is just that simple, and being a bank "for reconstruction and development," it is obvious that engineering must be one of its working tools.

Loan application preliminaries

Perhaps the best insight into the operations of the bank can be gained by following the course of a typical loan application. Let us assume that the Limestone Cement Co. has been organized in one of the smaller and less-industrialized member-countries for the purpose of constructing the nation's first cement plant, with a capacity sufficient to eliminate the need for imports.

Of the estimated total cost of the mill, about 30 percent will be spent for local labor and materials available within the country. This portion of the cost, therefore, can be paid for in the national currency, and Limestone Cement has received assurances from its local banking connections that the financing of this portion can be handled without outside assistance. The remaining 70 percent is required for equipment, materials and services which must be imported, largely from the United States, and a dollar loan in such an amount is to be sought from the World Bank.

As a first step leading to the formal submission of a loan application, the company arranges for an informal discussion with bank officials in Washington. Such preliminary talks are encouraged by the bank in order to enable applicants to familiarize themselves with policies and requirements, thereby forestalling wasted time and effort on loan applications that have no chance of favorable acceptance.

In the course of the preliminary negotiations, the representatives of the cement company determine that their proposal is of a type that the World Bank will endorse. In addition they receive assurances that if technical and financial studies confirm the feasibility of the project, and show that it will benefit the country's economy, consideration will be given to their formal loan application.

Since the prospective applicant is a private company, it must secure a guarantee of the loan by its government or by the central bank of the country. In this particular case, the government considers the project of vital importance to the nation's economy, and has no hesitation in pledging its support.

Limestone Cement Co. officials were aware of the fact that the technical and financial reports must stand the test of intense scrutiny by the experts of the bank, and that a most careful and convincing presentation of all underlying data would greatly shorten the period of investigation and enhance the chances of final acceptance of the application. They realized that since the bank must satisfy not only itself, but also the investing public, who are potential buyers of its bonds, the technical information required for the loan should be prepared in such a way, and by persons of such known reliability, that its validity would be beyond question.

Consulting engineers required

In view of the nature of the project, Limestone Cement Co., decided to retain a recognized firm of consulting engineers to prepare the necessary preliminary designs and estimates, and to present them in an over-all report. The qualifications sought in the consultants included not only professional competency,

but also a practical approach to the problem based on sound judgment.

The company realized, furthermore, that certain phases of the development required more detailed study, and desired the advice and assistance of experienced people who had the imagination to take advantage of the full potentialities of the project. It was considered especially important, in order that the report should carry its due weight, that the consultants should have established a reputation for integrity and impartiality, and for basing their conclusions on the facts as they found them.

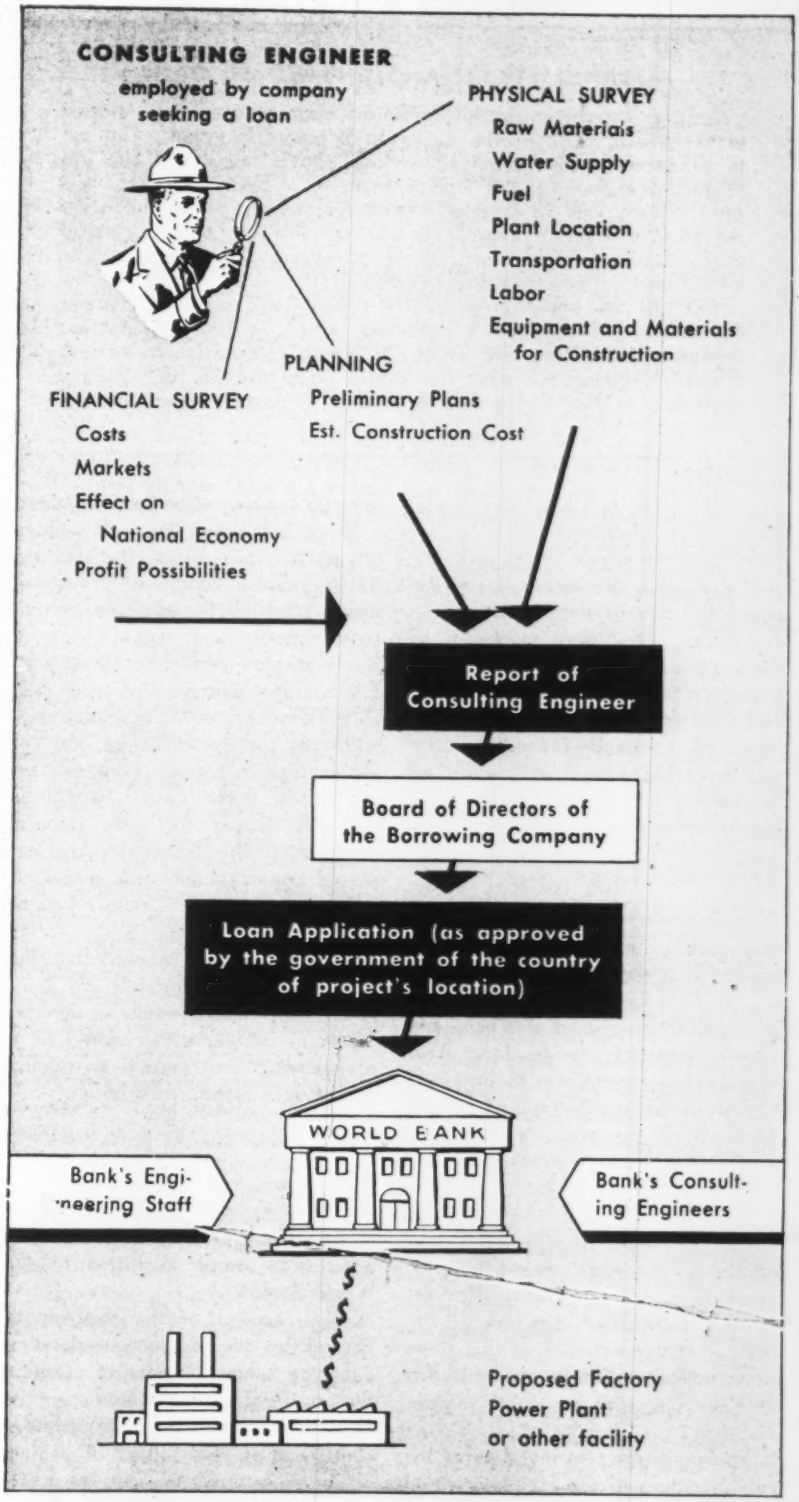
Wide scope of engineering study

After considerable investigation, the cement company engaged a well-known firm of engineers, which then began an exhaustive analysis of all the phases of the project. The first requisite was a survey of the raw materials, covering their location, accessibility and character. Since limestone is the principal raw material entering into the manufacture of cement, the engineers set out to find limestone deposits that would provide a sufficient supply for from twenty-five to fifty years, and then established a suitable nearby location for the plant. Sources of the other necessary materials, such as clay and gypsum, were located, and samples were subjected to careful laboratory tests. A survey of the potential water supply was made, and a method of making this water available to the plant was devised.

An extensive study was made to determine the availability of coal supplies, large quantities of which were to be required for the cement-manufacturing process. The problem here involved not only the mining of coal, but more particularly its transportation to the site of operations. This required a considerable study of alternative methods of transportation and possible joint use of transportation facilities by other enterprises in the country, before it became evident that the coal could be obtained for the plant at a reasonable cost.

After the engineers had satisfied themselves that raw materials could be produced economically, they proceeded with an estimate of the cost of the plant, including the labor and materials to be involved in construction, and equipment, transportation and technical assistance required. The time of completion was also estimated. A breakdown was prepared to show the costs to be incurred in dollars and those that could be met in local currency.

A third vital subject for investigation was the financial side of the project. Both the World Bank and the



HOW ENGINEERS FIT INTO WORLD BANK OPERATIONS

MARSHALL PLAN AND THE WORLD BANK

Mutual assistance without conflict characterizes the relation of the World Bank to the European Recovery Program. The aid to productive effort provided by the bank's loans and the aid projected under the ERP complement each other. Whereas the bank's loans will be largely utilized for capital goods and other materials producing tangible returns, the ERP can provide critical reconstruction needs which, while benefiting the economy as a whole, may not result in direct revenues.

ERP, by its broad program for revival, will provide a firmer foundation for the bank's activities, which in turn will further stimulate production and assist the member countries to achieve balanced economies. Both the World Bank and the ERP have a vital role to play in the enormous task of postwar rehabilitation.

national government were anxious to know what revenues would be derived from the sale of the plant's output, and what the trend of the demand for this product would be in the future. They were interested in the expenses for raw materials and labor that would have to be incurred, and wanted to know how much must be set aside annually for maintenance and depreciation, and what would be left to pay interest, commission and amortization charges.

Markets for cement

The financial studies included marketing investigations, which showed that the domestic needs during the next few years would absorb at least 90 percent of the proposed plant's capacity production. Two neighboring countries also imported cement so that ample demand for the products of the plant was demonstrated, even if indigenous consumption should not come up to expected levels.

On the basis of the marketing analysis, the plant's prospective revenues were estimated, and after deducting anticipated expenses of operation, the report showed that there were sufficient funds available for debt service, with an ample margin of safety.

The engineers also investigated the role that the new cement plant would play in the economy of the country, and prepared arguments to demonstrate the compatibility of the proposed loan with the general purposes of the World Bank. Of particular interest were the findings on the amount of foreign exchange that would be produced, directly or indirectly, through the output of the new plant.

Whereas in the past, all cement had been imported into the country, it was shown that the new plant would meet all the nation's current requirements, and would leave a small surplus available for export. The nation's merchandise trade balance, therefore, would benefit considerably in foreign exchange. Part of the savings in foreign exchange expenditures, it was found, would be available to pay for other imports necessary to the further development of the country, and such increased international trade would benefit other nations as well.

The studies also showed that the new plant would directly or indirectly give employment to several thousand people, which would be a considerable contribution to raising the nation's standard of living.

Engineers' findings go to bank

These reports and studies, together with the company's financial statements and other data required for the application, were submitted to the World Bank.

Upon receipt of the application, backed by its adequate supporting data, the bank proceeded to examine the proposal, and to determine its compliance with requirements—soundness of risk; effect of project on borrower-country and on international trade; productive character of the project; and ability of the project to produce the necessary foreign exchange for repayment of the loan. In this case, the bank might consider a fairly detailed examination necessary. In other cases the margin of safety of the loan may be so great that the principal questions will be in regard to compliance with the general policy and purposes of the bank.

Bank also uses engineers

In considering loans involving construction or technical developments, the bank itself will secure competent engineering counsel, either from qualified advisers who are regularly connected with it, or by employing consultants. Action along these lines will vary from case to case, and will depend upon the degree of complexity of the project.

After a loan has been approved and an agreement executed, the bank exercises supervisory control to insure that the funds are used in conformance with the loan agreement. No restriction can be imposed as to where purchases may be made, but the bank can and does insist that the goods and services purchased be used for the purposes set forth in the loan agreement.

The bank's emphasis on loans that stimulate production stems from its interest in promoting broad economic recovery and development in all member countries. Production in each country has two objectives: first, to fulfill domestic requirements, and second, to build up surpluses for shipment abroad in exchange for essential imports.

The bank aims to assist its member countries by financing their purchases of needed outside goods, with the stipulation that purchases must be for items that will increase the member's own productive power. The resulting increased production will enable the member either to satisfy a greater part of its domestic demands, thereby reducing the need for imports; or it will make available additional goods for export, increasing the country's ability to pay for purchases made outside its borders. In either case, adequate production is the key to bringing the country's economy into better balance and to promoting an increased standard of living.

Today, the productive plants of many countries involved in the war are operating at levels far below those needed to supply their minimum requirements. Machines frequently lie idle because of lack of repair parts; factories remain closed or operate at

a fraction of capacity because of shortages in fuel or critical materials. Coal mines fall short of targets because their equipment is worn out; steel mills are hampered by lack of coal; and shops capable of turning out mining machinery lack the steel required to produce. Enormous latent capacities are frequently tied up completely because of a few specific bottlenecks, the breaking of which would move a whole segment of industry off dead-center and start its revival.

The most rapid improvement in productive levels can be achieved by restoring existing facilities to active use. For this reason, the bank's first emphasis has been on reconstruction and rehabilitation. At a later stage, the development of new facilities will assume paramount importance, and plans for such projects are even now receiving consideration by the bank.

World Bank origin and capital

The World Bank grew out of the United Nations Monetary and Financial Conference held at Bretton Woods, N. H., in July, 1944. At this conference, articles of agreement, constituting the charter of the bank, were drawn up, and they became effective in December, 1945, after 28 governments had become signatories. By Feb. 1, 1948, this total had increased to 46.

The bank derives its capital by issuing stock to the member countries. The total amount of stock authorized is 10 billion dollars, and up to the date mentioned the members had subscribed the equivalent of $8,263,100,000. This does not mean that the bank has approximately 8 billion dollars in loanable funds, however, for only 20 percent of each member's capital subscription is required to be paid in to the bank. The remaining 80 percent constitutes a guarantee fund that the bank can call upon if its other resources should ever be insufficient to meet its obligations. The loanable capital funds subscribed, therefore, total $1,652,620,000, whereas the 80 percent reserve fund amounts to $6,610,480,000.

Of the paid-in portions of the capital that each country has subscribed, only 2 percent is required to be in the form of gold or United States dollars immediately available for loans. The remaining 18 percent may be paid in the currencies of the various member nations, and these funds can be loaned only with the consent of the country whose currency is involved.

At present, few countries other than the United States are in a position to allow free disposal of such funds. However, in connection with the Luxembourg loan, Belgium did agree to the use of the equivalent of two million dollars in Belgian francs out of its subscribed capital, which Luxembourg used for the purchase of railway equipment in Belgium. As production rises in various countries, it will be possible for them to permit foreign purchases, and increasing use will be made of the non-dollar capital of the bank.

During the current period, the preponderance of U. S. production causes the present demand for loans to be confined almost entirely to dollars. The bank's principal source of dollars, of course, lies in the subscription of the United States. The total amount of this subscription is $3,175,000,000, of which $635,000,000 represents the 20 percent paid-in portion. The United States has consented to the full use of its paid-in capital for loans. The unrestricted two percent contributions of the other members have also added to the bank's loanable capital in gold or U. S. dollars, so that the total hard currency available for lending is approximately $730,000,000.

Loanable funds are also derived from the marketing to investors of the bank's own bonds, which are general obligation securities supported by all its assets and resources. And as its operations progress, the bank will rely to an increasing extent on borrowed funds rather than on its paid-in capital for the main portion of its loanable resources. In this respect, the bank becomes an agency for utilizing funds available from private investors to assist in the reconstruction and development of member nations. In many cases, where individual investors would not risk loaning their funds directly to the nations involved, they are willing to make them available through the bank because of its large reserves and protective features.

Organization of the World Bank

The powers of the bank are vested in a board of governors, consisting of one representative appointed by each member country. The governors delegate most of their powers to a board of executive directors, numbering fourteen, of whom five are appointed by the five largest stockholders, namely, the United States, the United Kingdom, France, China and India; the other nine directors, most of them representing more than one

WORLD BANK NOT TO BE CONFUSED WITH THE EXPORT-IMPORT BANK

The Export-Import Bank was organized in 1934 as an agency of the United States government to aid in financing trade between this country and the rest of the world. It is authorized to make loans to any foreign country, its agencies or nationals. The World Bank, on the other hand, is an international organization deriving its authority from a charter ratified by its 46 member countries. Its function is to make loans in member countries for reconstruction and development purposes.

The authorized capital stock of the Export-Import Bank is $1,000,000,000, and its outstanding loans may not exceed three and one half times that amount. Management is vested in a bipartisan board of directors consisting of the Secretary of State and four full-time members appointed by the President.

Immediately after the war, and before the World Bank started to function, the Export-Import Bank engaged in a considerable number of reconstruction loans to European countries. As the World Bank began to operate in that field, the Export-Import Bank restricted itself principally to loans intended to finance exports and imports in the interest of trade development between the United States and other countries.

country, are elected by the governors of the remaining members.

The vote of each member in the board of governors and the board of executive directors is determined on the basis of the capital stock owned. Each $100,000 share of capital stock entitles its owner to one vote and, in addition, every membership carries with it a bonus of 250 votes. Thus, Chile, with a total subscription of $35,000,000, or 350 shares, is entitled to cast 600 votes; France, with 5,250 shares of stock, casts 5,500 votes; the United States, as the largest subscriber, with 31,750 shares, casts 32,000 votes. All the members together have 94,131 votes.

The administrative officers of the bank are elected by the executive directors. The president is John J. McCloy; the vice president, who also acts as general manager, is Robert L. Garner. There are eight department heads supervising the activities of a staff of about 400 persons drawn from 25 different nations.

How and to whom loans are made

The lending activities of the bank are capable of considerable flexibility. In addition to the granting of direct loans, the bank can also act as guarantor of loans made by private investors, or it can participate in loans that are partly financed through the usual investment channels. In fact, one of the chief purposes of the bank is to promote private foreign investment by these two means.

Maturities of loans can also be adjusted according to circumstances. The longest loan so far made by the bank is for a term of 30 years, but it can also make short and medium term loans, depending upon the anticipated life of the equipment supplied or upon other economic and financial considerations.

The bank's charter authorizes it to make or guarantee loans to any member or political subdivision thereof, and also to any business, industrial or agricultural enterprise located in the territories of a member. When a member is not itself the borrower, repayment of the loan must be guaranteed by the member government in whose territory the project is located, or by the central bank or comparable agency of the member. While the bank has authority to make loans, it cannot engage in equity financing.

Each of the 46 member nations in the bank is equally entitled to apply for and receive loans. The size of a loan that may be granted to a member has no relation to the member's capital subscription, but each loan application must thoroughly demonstrate the economic soundness of the project proposed.

Non-partisan approach

Political considerations are specifically ruled out as criteria for loans, except as they may affect prospects for repayment. The political complexion of a member is not to affect the decision on granting a loan, and the bank's charter prohibits it from interfering in the political affairs of any member. This non-partisan attitude must be maintained if the bank is to give fair service to all its members and to fulfill its role as an international institution devoted to economic reconstruction and development.

The officers and staff of the bank are required to conform to standard banking practices in passing upon loans, and to obtain every reasonable assurance that loans will be repaid. The principal differences between the World Bank and a commercial bank lies not so much in the methods employed as in their respective purposes. Whereas a commercial bank is influenced primarily by the prospects for profitable investment, the World Bank aims to encourage productive enterprise and world trade, and is directed by its charter to give "due regard to the effect of international investment on business conditions in the territories of its members."

In selecting projects for assistance, the bank attempts to deal first with "the more useful and urgent projects," regardless of size. It is not interested in securing the greatest possible return on investments, but seeks only enough margin to meet expenses and provide prudent reserves.

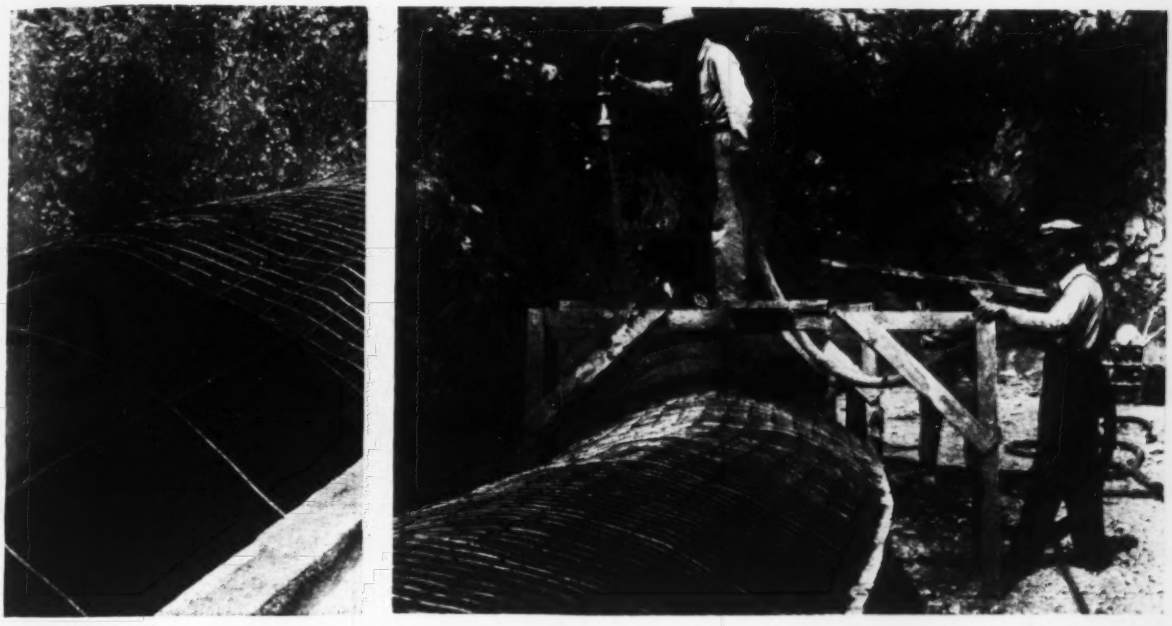
The loans made by the bank may vary greatly in type and size. They may be used to finance the replacement or modernization of a country's railroad equipment, of its coal mines, steel mills or chemical plants; in other words, they can play a part in the general overhaul of the industrial plant of a country. World Bank financing can, likewise, be used for a related series of projects designed to tap the wealth of an undeveloped country in a systematic manner. But the bank can also take a hand in comparatively small and isolated projects—an extension to a port, an electric power plant, a sawmill or any other useful form of capital investment. The principal criteria considered do not concern size, but the productive contribution that will be made to the member's economy and to international trade, coupled with soundness of risk.

Obviously, the bank's loans will bring substantial benefits at many levels. Not only will the recipients' economies be stimulated, but so will international trade and, thereby, the economies of other nations as well. It is noteworthy, also, that the initial expenditures involved in creating the facilities financed by the bank will result in large-scale opportunities for all industries and services connected with the construction and the equipment and supplies required for the projects. These will include engineers, contractors, transportion facilities and many types of manufacturing establishments. Thus, in all stages of its activities, the bank will produce tangible benefits for the peoples and economies of the world.

Concrete Difficulties In Maritime Provinces

The Nova Scotia Research Foundation, recently organized, has joined the Nova Scotia Technical College and the Dalhousie University, both at Halifax, N. S., in an investigation of masonry decay in the maritime provinces. Expenditures for repair and maintenance on masonry in the Atlantic provinces are estimated at about $1,000,000 annually. Studies have included making test mortars, these being tested for tensile strength; many samples of mortars from buildings that have been affected by the decay, have been examined; efforts have been made to determine effects of frequent freezing and thawing and of salt laden fog.

Also under study is "growth" of concrete at a large power plant on the Mersey River. The growth was first noticed in 1941 as it had resulted in machinery being moved out of alignment. The machines were realigned but the growth is continuing.



One-quarter inch rods support form (left) for application of gunite that serves as a cover for California irrigation flume.

Low-Cost Irrigation Flume Cover

Linden R. Burzell
Assistant Engineer
Vista Irrigation District
Vista, Calif.

To prevent loss of capacity due to algae growth and caddis fly infestation in an open concrete irrigation flume, the Vista Irrigation District in San Diego County, Calif., recently placed a thin gunite covering on some 8,400 ft. of flume. The low cost of $1.18 per lin.ft. was obtained by use of an arched gunited cover formed on a combination form and wire-mesh reinforcement.

During the summer months, the coefficients of flow for the 12½-mile flume were reduced so much that water overflowed the ditch, necessitating a flow reduction. This condition was primarily due to caddis flies—the larvae of which live under water and are wormlike in appearance. These tiny "worms" spin a cocoon similar to a rice husk that is left on the walls of the flume after the fly matures.

Many attempts were made to protect the flumes (4 ft. 3 in. wide and 3 ft. 2 in. deep) by means of paints, greases, and chemicals. None of these expedients proved successful, and a cover was considered as the last resort. Most covers tried, however, proved too expensive or impractical and it was not until the arched gunited cover was worked out that the work went ahead.

The cover form was supported by ¼-in. round rods spaced on 2-ft. centers with three longitudinal ¼-in. round rods. A special floor lath, which comes in rolls 4 ft. wide, was cut to form the arch and tied to the rods. The 4-ft. width proved adaptable to the many curves on the flume as variations in alignment could be accommodated by lapping the 4-ft. panels. This floor lath consists of No. 12 wire spaced 3x4 in. on a cord-reinforced water-resistant backing.

Expansion joints were made by wiping out a 1-in. width of green gunite every 100 ft. Reinforcing wire underneath this wiped-out section was cut. The joint was then covered with an 8-in. strip of asbestos roofing paper and this was covered with asphalt. Manholes of redwood were placed ahead of the contractor and the lath was tied into them.

Gunite was applied by use of portable equipment, with sand and cement batched before being brought to the job and fed into the equipment. The cover averaged 1 in. in thickness and it was strong enough, after it had set, to support the weight of a workman.

After the concrete was cured by means of a clear curing compound, the cover and the side walls of the flume were whitewashed. This coating reflects much of the sun's heat and has practically eliminated expansion cracking of the flume that had been troublesome.

Cover eliminates flies and algae

The resultant cover completely eliminated caddis flies and algae as well as wind-blown leaves, seeds, and trash. Rodents and other small animals were prevented from falling in the flume. Plans are now being made to cover an additional 12,750 ft. of flume and eventually it is planned to cover the entire 12½ miles.

Contractor on the job was Johnson Western Co., for whom E. E. Jackson was superintendent. H. H. Yackey is manager of the Vista Irrigation District and the work was handled for the district by the author.

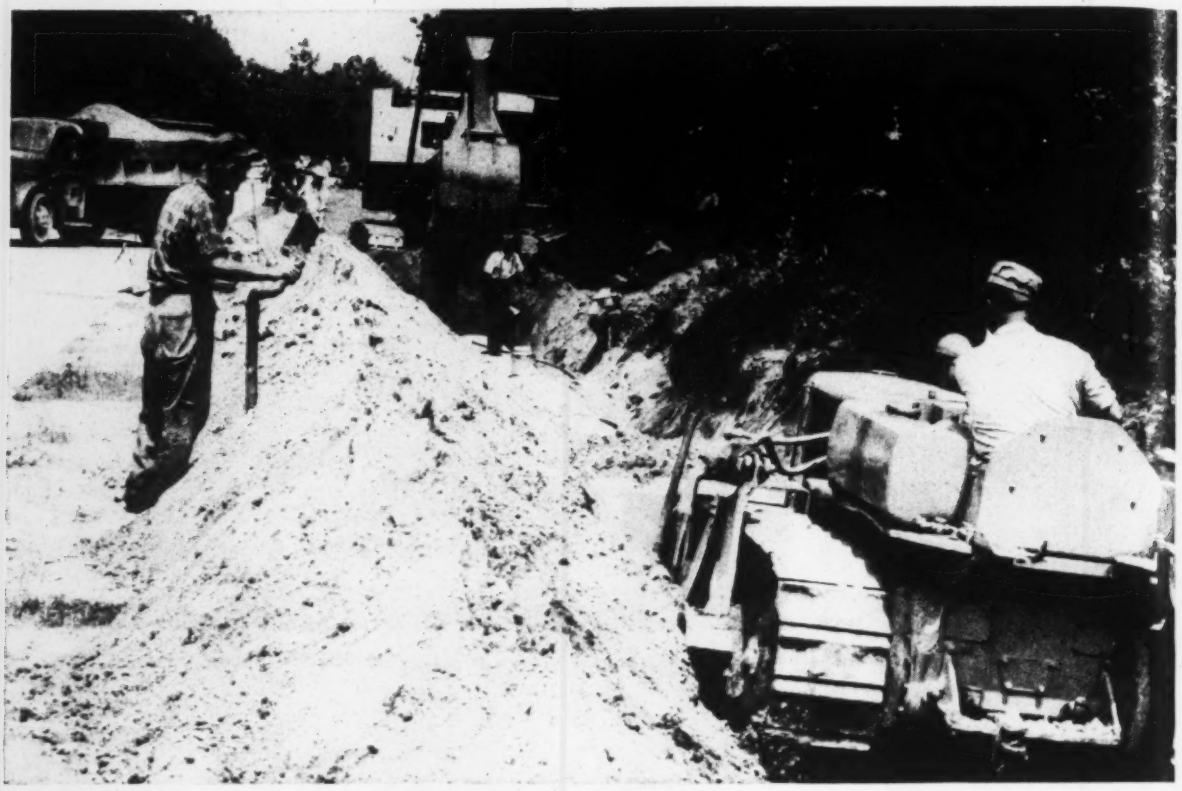


Fig. 1. Back hoe and bulldozer were principal equipment for concrete pipe-laying on the 78-mi. Saginaw-Midland water line.

Laying 60 mi. of Pre-Stressed Pipe

***Contents in Brief**—Two casting plants and ten construction crews made and laid 60 mi. of large prestressed concrete pipe last year on the 78-mi. Saginaw-Midland water line project, scheduled for completion this summer. All 48-in. and 36-in. pipe were cast in 16-ft. lengths, trucked from plant to job and installed with the same back hoe that excavated the trench.*

NEWEST METHODS of manufacture and installation of large pre-stressed concrete pipe paid dividends in speeding the job last year on the Saginaw-Midland, Mich. water-supply pipeline project, when two large casting plants manufactured—and ten construction crews installed—60 mi. of 48- and 36-in. pipe.

Although it was to be expected that similar methods would be employed in both casting plants—one of which held a contract for making 254,500 ft. of 48-in. pipe and the other a contract for 142,550 ft. of 36-in. pipe—it is interesting to note that nine of the ten construction crews followed virtually the same procedure in laying pipe.

As reported in a previous issue (*ENR* April 29, Vol. p. 646), the $12,000,000 project includes 48 mi. of 48-in., 27 mi. of 36-in., and 3 mi. of 24-in., all pre-stressed concrete pipe. The 48-in. line connects two pumping stations now under construction; one at Whitestone Point where the intake is to be located in Lake Huron and the other at a junction with two 36-in. lines.

One of these lines extends 14 mi. south to the Saginaw filtration plant. The other runs due west 13 mi. to the Dow Chemical plant, followed by 3 mi. of 24-in. pipe to the Midland filtration plant.

The 48-in. pipe-casting plant was set up at Pinconning, Mich., about midway of the 48-in. line. The 36-in. pipe plant was located at Bay City, just east of the junction. The 24-in. concrete pipe was manufactured in the east and shipped in by rail.

First operation in manufacturing the concrete pipe was to form the steel cylinder, inside of which was cast a concrete core. These cylinders were made of light-gage steel sheets, shipped flat to the plants, rolled to correct form and welded longitudinally to form 40½-in. or 54-in. inside diameter cylinders. Galvanized steel joint rings were welded to the ends of each steel cylinder.

Since this cylinder with its joint rings constitutes the watertight element of the pipe, it was tested under hydrostatic pressure to assure strength and watertightness of each weld. Any leakage apparent in the cylinder was repaired by additional welding and the cylinder was tested again.

Next the cylinder was lowered over an inside casting mold. Concrete was poured between cylinder and mold to specified thicknesses shown in the accompanying table to form a concrete

core having an inside diameter of 36 in. or 48 in. All concrete was vibrated with external vibrators attached to the forms.

After the core had been sufficiently cured both in a steam bin and in the open, it was wrapped with high-tensile wire under a high and constant tension determined by conditions of the pipe's design. Final step was to coat the pre-stressing wire with a dense covering of rich cement mortar.

All pipe were cast in 16-ft. lengths. Each length of pipe has a bell and a spigot end formed by the joint rings. These rings are self-centering, with the spigot end containing an annular groove to accommodate a rubber gasket.

Casting the concrete pipe

At both casting plants the concrete aggregates and cement were delivered by rail to a central batching and mixing plant. Aggregates were bottom-dumped onto an endless belt and elevated by bucket conveyor into bins above the mixer. Cement was handled from car to bin by screw conveyors. Concrete at both plants was mixed in 2-cu.yd. portable mixers located below the batching plant.

At the 48-in.-pipe plant, concrete was dumped from the mixer into 2-cu.yd. special bottom-dump buckets and transported on narrow-gage track to the molds located in large steam chests. Concrete buckets were elevated by crawler crane and discharged into special loading buckets set on top of the molds to be filled. Four such buckets were used to insure continuous operations and they, as well as the molds, were moved as necessary by the crane. Steam-bin capacity was provided for a total of 264 pipe at this plant, with maximum production of 88 pipe per day.

Casting operations at the 36-in. pipe plant followed the same general pattern of the other plant except that concrete was transported from mixer to molds by a locomotive crane operating on rails paralleling the mixing plant and steam-bin assembly line.

This crane also moved the four pouring buckets, placed empty molds in the steam bins and removed the concrete pipe and molds from the bins. Total steam-bin capacity at this plant was 150 pipe, with maximum production running 50 pipe per day.

Each 16-ft. length of 48-in. pipe weighed six tons. They were loaded at the plant by a 1½-cu.yd. crawler crane, hauled to the various pipe-laying jobs on multi-wheel, low-bed trailers, and unloaded by a 20-ton truck crane. Three sections of pipe constituted a load.

Fig. 2. Nine of the ten pipe-laying crews installed pipe with the trenching back hoe. The other laid pipe with a crane.

The 36-in. pipe was hauled to the jobs by truck-trailers, four sections to a load. They were loaded onto the trailers by a truck-mounted winch, and unloaded by hand winches mounted on the trailers, or by manila ropes snubbed around reinforcing pipes forming the sides of the trailer beds. Timber skids were used both in loading and unloading.

Two contracts were awarded for installation of the 48 mi. of 48-in. pipe, one was awarded for the 14-mi., 36-in. Saginaw branch line and one for the Midland branch including both the 13 mi. of 36-in. and 3 mi. of 24-in. pipe.

TABLE OF PRESTRESSED CONCRETE PIPE DIMENSIONS

Inside diameter of pipe (in.)	48	36	24
Core thickness (in.)	3	2¼	1½
Mortar coating (in.)	¾	¾	¾
Sheet steel cylinder (gage)	14	16	16
Pre-stressing wire:			
Gage	6	6	6
Spacing (in.)	0.45	1	0.67
Weight of 16-ft. pipe (ton)	6	3½	1½

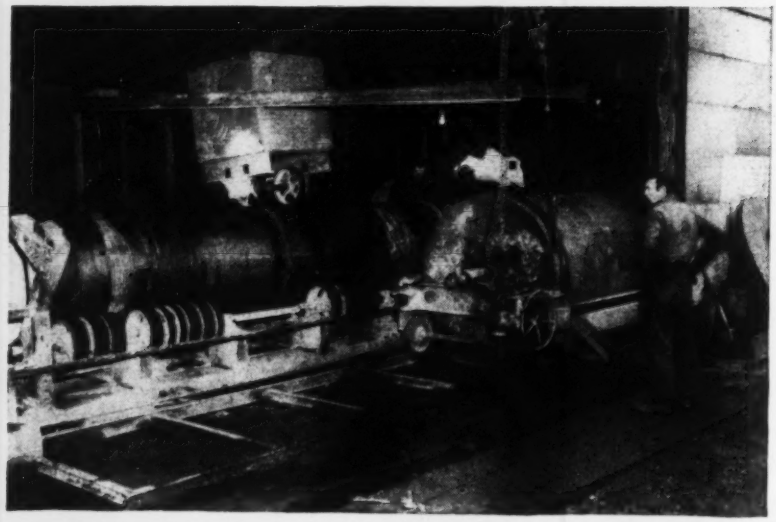
Taking full advantage of good weather during the 1947 construction season, the four pipe-laying contractors, together with one subcontractor on 8 mi. of the 48-in. pipe, put a total of 10 crews at work. As a result, total lengths of concrete pipe laid by Jan. 1, 1948 were: 210,600 ft. of 48-in.; 110,000 ft. of 36-in.; and 2,800 ft. of 24-in.

Comparative pipe-laying methods

Pipe-laying methods of the ten crews followed very much the same pattern, with one exception. All crews excavated the trench with a trench hoe, or back hoe, and backfilled with a bulldozer. One crew only installed the pipe with a crawler crane—the nine other crews used their trench hoe to install the pipe as they went along.

In general, the pipe followed the contours of the ground, with a 3-ft. minimum coverage of earth. Most of the pipe was laid along existing highway right-of-way, furnished without cost by the counties and the Michigan state highway department.

The concrete pipe was delivered by



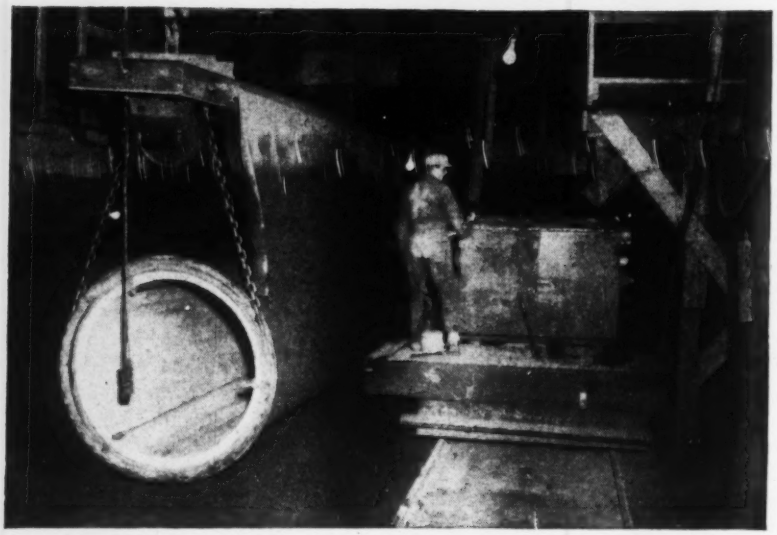


Fig. 3. Concrete pipe was cast and cured in steam bins (top), prestressed with high-tensile wire (center) and coated with dense mortar (bottom). Railroad and crawler cranes were used to move materials and finished pipe.

the manufacturing companies and distributed along the right-of-way, near its center line. On each job the length of open trench was kept to a minimum both from a safety standpoint for highway traffic often traveling nearby, and to reduce the possibility of bank-caving.

For those crews that installed the pipe with a back hoe, the general procedure was to excavate a 16 ft. length of trench and check the bottom of the trench for grade and alignment. A lifting cable was centered around a section of pipe, with its looped-ends engaging a two-pronged hook which, in turn, was fastened by a short cable to the boom of the back hoe.

The pipe then was lowered into the trench, its spigot-end inserted with rubber gasket in place into the bell-end of the previsously laid length of pipe, centered, and shoved tightly into place under about a 6,000-lb. strain on the lifting cable.

Best day's records

Best day's work, in total production, was 61 lengths of 36-in. pipe installed in 9 hrs. by a 23-man crew using a $1\frac{3}{4}$-cu.yd. back hoe for excavation; a 20-ton crawler crane for placing pipe; and a crawler tractor with bulldozer for backfilling. One 12-man crew laid 55 lengths of 48-in. pipe in twelve hrs. using a back hoe for excavation and pipe laying and a bulldozer for backfilling.

Another crew of men with back hoe and bulldozer installed 36-in. pipe on an average of one 16-ft. section every 15 min. of working time over a 30-day period. Three other 15-man crews, on 48-in. pipe, had maximum daily records of 32, 30, and 17 lengths of pipe, respectively, for a 10-hr. day.

In open country, most of the pipe-laying was in the dry and excavation was rapid and easy, with practically no rock encountered. Some sections of the lines had to be wellpointed to lower the groundwater table, but even then no shoring was needed—the contractor preferring to flatten the trench slopes rather than to shore.

One contractor established an incentive system to increase production. A base rate was established of one section of 36-in. pipe installed and backfilled every 25 min. of working time. For each additional section of pipe installed, each man in the crew received a bonus of 25 cents. In

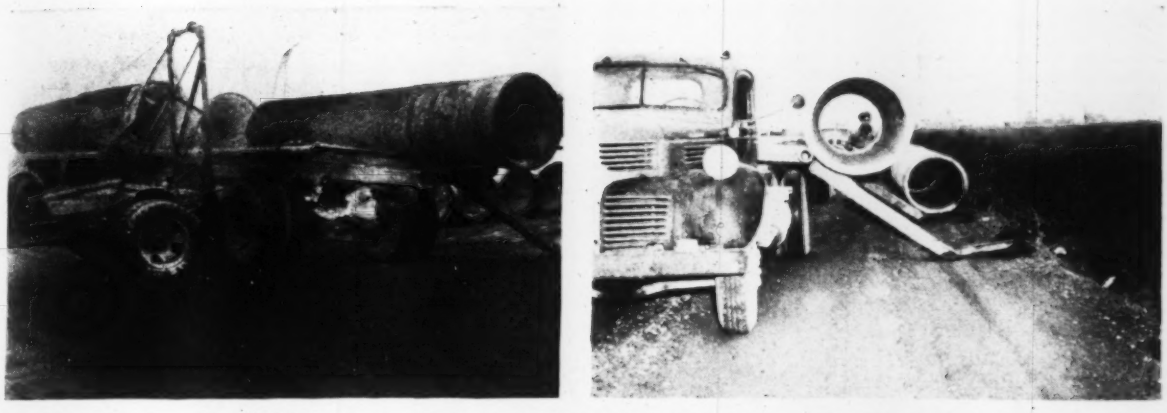


Fig. 4. At the 36-in. casting plant, pipe was loaded onto long trailers by truck-mounted winch (left). At the job it was unloaded by hand-winch and timber skids (right).

Fig. 5. Joints were sealed with solid rubber gasket inserted in annular groove provided in galvanized steel joint ring at spigot end of pipe.

towns, where existing water, gas and sewage lines increased the difficulties of pipe laying, the base rate for this bonus system was adjusted.

Although existing public service facilities in towns and villages hampered the pipe-laying operations, everything possible was done to expedite work. Plan and profile drawings, prepared by consulting engineers in charge of the project, indicated the location and depth of all known water, gas and sewage lines.

In the case of existing water lines, the contractor sent a crew ahead of pipe-laying to expose lines by hand excavation, freeze them with dry ice and install a valve.

When pipe-laying crews reached that point, the water was shut off for a short interval while trench excavation was made. The concrete pipe was installed and a new section of pipe installed in the existing water line, either looped under the concrete pipe or passing above it.

Interfering gas lines were cut with a hacksaw and plugged temporarily while the new concrete pipe was laid. Then the gas line was placed in service, often by inserting the original length of old pipe that had been removed and making sleeved connections with couplings that did not require threading of pipe.

When an old sewer line interfered with the new work, a short length of it was ripped out and replaced with an elbow passing beneath the new crete pipe. In some cases the old sewer could be raised to clear the pipe being installed. Frequently this work entailed additional tunneling to adjust the old sewer on either or both sides of the new water line.

The installed pipe depends for its sealing against hydrostatic pressure at each joint on a $\frac{1}{2}$-, $\frac{5}{8}$-, or $\frac{3}{4}$-in. solid rubber gasket installed in a groove provided around the spigot end of each section of pipe. In addition, the inside of each joint was troweled smooth with a stiff mortar to reduce the coefficient of friction between water and pipe.

The outside of each joint also was mortar-coated, primarily to protect an exposed portion of the steel joint ring. To apply this coating of mortar, a double layer of special paper was wrapped around each joint and a thin sand-cement mortar poured in the joint at the top of the pipe and permitted to flow around it, inside the collar.

Construction superintendents for the five concrete pipe-laying contractors include: H. S. Knight for Price Bros. Co., and Roy P. Hess for Charles F. Smith and Son, both companies of Dayton, Ohio; Don Wells, L. W. Wells Construction Co., Saginaw; A. A. Hruschka, Bass Engineering and Construction Co., and Thomas D. Nolan, joint venturers of Birmingham, Mich. L. H. Brenner was chief engineer for Johnson-Greene Co., and Walter Toebe Co., of Ann Arbor, Mich., joint subcontractors on 43,000 ft. of the 48-in. pipe.

L. G. Wilhelm was manager of the Lock Joint Pipe Co. 48-in. concrete pipe plant at Pinconning, and Paul L. Osweiler was in charge of the Price Bros. Co. 36-in. casting plant at Bay City.

V. R. Kneer is project engineer for Alvord, Burdick and Howson, Chicago, consultants in charge of the work, and Alfred Eckert, manager of the Saginaw-Midland system represents both cities on construction.

REFUSE DISPOSAL PRACTICE AND COST

Factual data from 300 cities in the United States classified by size and geographical regions, provides the background for an analysis of collection, disposal and financing methods

MUNICIPAL refuse collection and disposal practice in the United States has only one common denominator —and that is variety. The reason, of course, is obvious when we consider that size of city, its physical layout, regional location, financial condition and its management (to mention only a few factors) permit an almost infinite number of variations in handling a product which in itself is distinguished by its constant variability.

Reports from 300 cities

To determine to what extent certain practices might be favored, *Engineering News-Record* collected the facts from some 300 cities. The results, shown in the tabulation on page 602, represent a consolidation of detailed data furnished by public-works directors, city engineers and other municipal administrators in various parts of the country.

It will be noted that the data has been classified under three major functional headings—collection, disposal and financing practice—and also includes a section on volume increase and incinerator planning. These data are organized so that the distribution is shown by city-size and geographical grouping. By way of definition, the term refuse is all inclusive, representing the combination of garbage, rubbish and ashes.

Collection frequency proved the most complex practice to analyze because of the variety of schedules within individual cities. The accompanying tabulation and Fig. 1, which show prevailing practice, should be recognized, therefore, as deceptive simplifications. One city, for example, will make a single collection weekly in residential areas, two collections in apartment areas and six in the business district. Another city makes four garbage collections weekly, six in the business district, six rubbish collections weekly and one trash collection per month.

In many cities, garbage and rubbish collections are made on different schedules. Also evident is the fact that winter collections are less frequent than those maintained in the summer period. But in both summer and winter the prevailing practice is one or two collections per week.

Greater frequency of collections in business districts is reported by 16 percent of the cities, with six collections weekly representing a general average in most of these places. Several cities, it was noted, plan to increase collection frequency when new equipment on order has been delivered.

Interpretation of data

From the statistics assembled, it is possible to reach certain conclusions whose validity, heretofore, lacked proper factual background. For example, while it is generally acknowledged that refuse collections have increased in volume since the prewar period, no measure of this increase has been available.

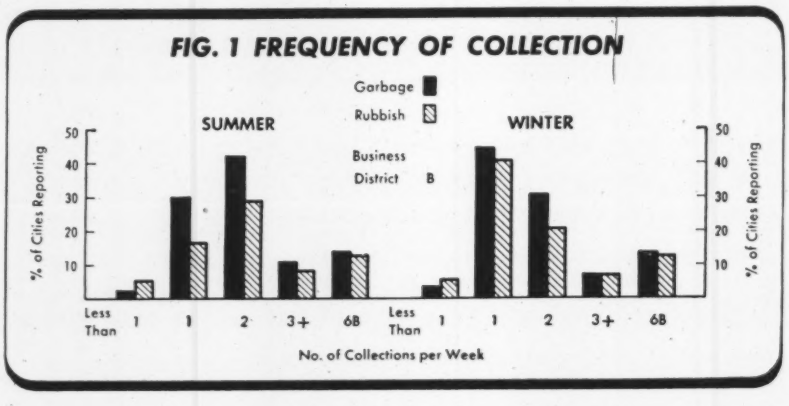
The *ENR* survey indicates that in the majority of the reporting-cities (about one-third had no data, most of which rely on private collectors), the increase was less than 50 percent over 1939 (See Fig. 2). One city reported a 400 percent increase and a few registered 200 percent increases. Where decreases occurred these were explained as due to separate paper collections or as the result of changes in home-heating from coal to oil or gas. Geographically, the areas where the largest number of increases occurred were in the South, Middle-Atlantic, Midwestern and West-of-Mississippi regions.

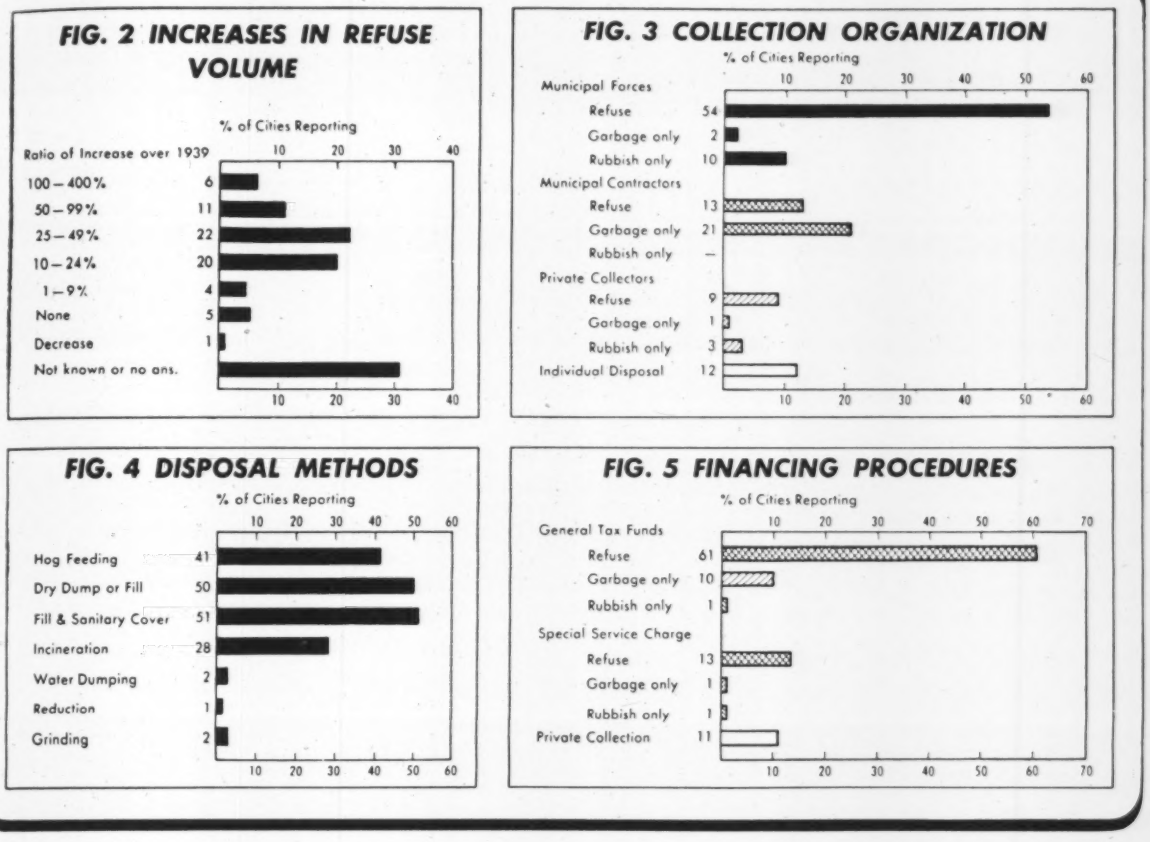
Municipal forces used

In regard to collection methods, it comes as no surprise that the favored method is by the use of municipal forces. Some 164 cities collect all refuse in this manner, 7 others garbage only and 29 rubbish alone, in contrast to 38 using contract services for refuse and 63 for garbage alone. Private collectors of refuse were reported to be operating in 26 places, of garbage only in 4, and rubbish only in 8. (Fig. 3).

In 37 cities, mostly in the 10-50,000 population groups, and in New

FIG. 1 FREQUENCY OF COLLECTION





England, Middle West and West of Mississippi, it is left to home owners to make their own arrangements for refuse disposal.

Hog-feeding and dumps predominate

The predominant methods for disposal are hog feeding (41 percent) and the use of dumps (37 percent), according to the survey data.

Incineration is employed in 28 percent of the cities. Of significant interest, however, is the fact that the number of cities planning new incinerators almost equals the number already using them. It might be concluded, therefore, that the trend, particularly in the New England and Middle-Atlantic regions, is toward incineration of municipal wastes.

Sanitary-fill methods are used in 25 percent of the reporting cities. This type of disposal is relatively new, and many of these installations reflect practice that has been adopted only within the last few years. Among the miscellaneous methods of disposal are listed central garbage-grinding, garbage reduction and dumping of refuse at sea or in rivers.

Graphical representation of variation in disposal methods is given in Fig. 4.

Where percentage figures total more than 100, the explanation rests in the fact that some communities employ more than one method.

Mechanical equipment favored

This being the initial survey of its kind, there is little opportunity to assess changes and trends. However, it is noted from the many comments received that there is a decided movement toward the adoption of mechanically loaded collector vehicles. Here are some typical findings:

Packer-type units are needed by, or on order for, 46 cities with another city buying 130 collection bodies of its own design. One Connecticut city is going to re-equip completely with packer bodies and build incineration facilities; a southern city will order several packer-type units "when we can get the garbage to the curb".

A Florida city is working to eliminate use of all open trucks and replace them with closed models: in Ohio, one city reports the need for 105 enclosed vehicles, has 10 in operation and 45 on order. In Texas, one city wants 12, and another 20 of the packer-type bodies.

Garbage trucks are needed by six cities, type not indicated, dump trucks by eight cities, and trucks and rubbish trucks by 22 cities. Replacement trucks are needed by nine cities, one of which expects to secure "a whole new outfit".

A Mississippi town cites the need of a suction-pump and truck for leaves and light trash as a major requirement. And a Michigan city calls for replacement of its big semi- and 4-wheel trailers for hauling garbage to hog farms.

Sanitary-fill equipment is required by 14 cities, including a ¾-yd. dragline, a power shovel; 8 cities need "bull clams" and tractors.

In contrast to the upstate New York municipality that precisely lists $1,500,000 of equipment on order, one city sums up its greatest need

ENR Survey of Refuse Disposal Practices—1947

	TOTAL		BY LOCATION						BY SIZE OF CITY							
	Number	Percent	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	1,000,000 & over	500,000–1,000,000	250,000–500,000	100,000–250,000	50,000–100,000	25,000–50,000	10,000–25,000	5,000–10,000
Number of Cities Reporting	302	100	42	69	44	63	59	25	1	3	10	24	42	75	143	3
Percent of all Cities in Size Group	28	—	—	—	—	—	—	—	20	33	44	44	39	35	22	—
Increase in Refuse Load over 1939																
100–400%	17	6	—	3	2	4	8	—	—	—	1	1	—	6	9	—
50– 99%	33	11	4	2	8	6	6	7	—	—	2	2	4	12	13	—
25– 49%	67	22	2	12	19	13	12	9	1	—	1	6	16	16	27	—
10– 24%	61(1R)	20	9	19	7	16(1R)	7	3	—	2	2	5	7(1R)	14	29	2
1– 9%	11	4	4	4	—	3	—	—	—	1	2	1	1	2	3	1
No increase	16(1G)	5	4	5	1	1(1G)	5	—	—	—	1	2	4(1G)	2	7	—
Decrease	3	1	1	2	—	—	—	—	—	—	—	—	—	1	2	—
Methods of Collection																
Municipal Forces: Refuse	164	54	13	34	43	33	31	10	1	2	7	16	31	43	63	1
Garbage only	7	2	1	—	—	4	1	1	—	—	1	1	1	1	3	—
Rubbish only	29	10	12	6	1	5	3	2	—	1	—	2	3	6	17	—
Municipal Contract: Refuse	38	13	4	11	—	9	7	7	—	—	—	—	4	10	21	3
Garbage only	63	21	20	15	1	11	13	3	—	2	2	6	5	14	34	—
Rubbish only	1	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—
Private Collectors: Refuse	26	9	3	10	—	4	6	3	—	—	1	1	1	5	18	—
Garbage only	4	1	—	—	—	2	2	—	—	—	—	—	—	2	2	—
Rubbish only	8	3	3	1	—	1	1	2	—	—	—	3	2	2	1	—
None—Individual Disposal	38	12	10	7	—	10	10	1	—	—	2	2	2	9	23	—
Number of Collections—per week																
Garbage—Summer																
Less than 1	6	2	5	—	—	—	—	1	—	—	—	—	—	3	3	—
1	90	30	14	16	8	36	10	6	—	1	4	7	17	25	35	1
2	127	42	10	33	19	28	28	9	1	1	5	9	15	31	63	2
3 or more	33	11	4	7	12	—	7	3	—	—	1	6	5	8	13	—
Business Area Daily	41	14	1	3	14	4	14	5	—	—	3	3	5	11	19	—
Rubbish—Summer																
Less than 1	14	5	5	4	—	2	—	3	1	—	—	—	1	6	6	—
1	97	32	17	17	8	36	11	8	—	2	5	8	19	23	39	1
2	87	29	5	24	19	12	22	5	—	—	2	6	10	23	44	2
3 or more	24	8	1	4	12	—	5	2	—	—	1	3	5	8	7	—
Business Area Daily	38	13	1	3	14	4	10	6	—	—	3	2	5	12	16	—
Garbage—Winter																
Less than 1	8	3	5	—	—	2	—	1	—	—	—	—	—	3	5	—
1	132	44	17	23	13	48	23	8	—	2	5	8	20	33	63	1
2	93	31	10	28	16	13	18	8	1	—	4	10	12	26	38	2
3 or more	22	7	1	4	10	—	4	3	—	—	1	4	5	5	7	—
Business Area Daily	40	13	1	3	14	4	13	5	—	—	3	3	5	11	18	—
Rubbish—Summer																
Less than 1	14	5	5	2	—	4	—	3	1	—	—	—	1	6	6	—
1	124	41	18	24	13	40	21	8	—	2	5	9	21	28	58	1
2	63	21	4	18	16	5	15	5	—	—	2	5	8	21	25	2
3 or more	20	7	1	4	10	—	3	2	—	—	1	3	5	5	6	—
Business Area Daily	37	12	1	3	14	4	9	6	—	—	3	2	5	12	15	—
Methods of Disposal																
Hog Feeding	125	41	26	19	3	34	28	15	1	1	4	11	17	32	58	1
Dry Dumping or Fill	114	37	18	28	21	19	23	5	—	3	2	10	11	27	58	3
Rubbish only	33	11	5	9	2	7	5	5	—	—	1	2	9	8	13	—
With open burning	7	2	—	1	3	—	2	1	—	—	—	1	2	2	2	—
Fill and Sanitary Cover	72	24	8	12	17	13	14	8	—	1	3	8	11	18	31	—
Rubbish only	3	1	—	—	—	1	2	—	—	—	1	—	1	—	1	—
Incineration	79	26	5	29	20	13	7	5	—	1	7	8	15	21	26	1
Rubbish only	6	2	2	3	—	—	—	1	—	1	—	1	2	2	—	—
Dumping: River	4	1	—	—	—	1	3	—	—	—	—	1	—	1	2	—
Sea	1	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—
Reduction	3	1	1	1	—	—	—	1	—	—	—	1	1	—	1	—
Grinding: Central	2	1	—	—	—	2	—	—	—	—	—	1	1	—	—	—
Indiv. Res.	3	1	—	—	—	2	—	1	1	—	—	—	—	1	1	—
Plan to Build Incinerator	59	20	13	18	7	9	5	7	1	2	6	5	11	11	23	—
Methods of Financing																
General Tax Funds																
Refuse	184	61	29	45	42	35	22	11	1	3	6	18	35	47	71	3
Garbage only	30	10	6	6	—	9	7	2	—	—	3	3	1	8	15	—
Rubbish only	3	1	—	—	—	1	1	1	—	—	1	—	—	1	1	—
Special Service Charges																
Refuse	40[a2]	13	—	5[a1]	2[a1]	11[a1]	16[a2]	6	—	—	1	1	3[a1]	10[a2]	25[a2]	—
Garbage only	4	1	—	—	—	—	3	1	—	—	—	—	1	—	3	—
Rubbish only	2	1	—	—	—	—	1	1	—	—	—	—	1	—	1	—
Private Collectors	33	11	4	9	—	8	9	3	—	—	—	3	2	7	20	1

[a] To Business District only, 5 cities, [1] sell steam, [2] charge for service to neighboring city, [3] annual appropriation, [4] one additional emergency tax, [5] from parking meter receipts, [6] from water department revenue, [7] street funds for general trash

as simply "something to eliminate the use of manpower."

Financing and costs

In large measure (72 percent), municipalities still rely on general tax funds for financing refuse disposal operations. Special service charges are employed in 15 percent of the communities surveyed. The balance of 11 percent represents cities in which service is arranged and paid for by householders who individually contract for this. (See Fig. 5).

An effort was made to evaluate data on costs that could be reduced to a basic unit, such as cost-per-year-per-capita, and thus establish at least a maximum-median-minimum area for exploration. Fredericksburg, Va. provided a detailed cost analysis, and this showed $2.1434 per capita per year, of which $1.196 was for collection and $0.9474 for incineration and can-washing operations. So, also, did Oak Park, Ill., whose $3.740 per ton for garbage collection, $1.318 for disposal (incineration) and $0.949 per cubic yard for noncombustible rubbish collection and disposal could be translated to $2.2947 per capita per year, $0.98 for garbage and $1.3147 for ashes and rubbish.

The costs shown in the accompanying tabulation have been computed by *Engineering News-Record* from reported data on tonnages handled and cost per ton. Obviously, costs will depend upon standards of service, frequency of collection, methods of disposal, as well as other factors, and cannot be compared, therefore, except by careful analysis and definition.

Furthermore, quantity measurements are not "controlled" or uniform in all cities, some are estimates, and thus unit cost based on tonnage or yardage handled are subject to varying degrees of accuracy. Even the yardstick of cost-per-year-per-capita-served has limitations, not the least of which is concerned with population-growth counts.

With full recognition that the data are subject to all the foregoing limitations, the unit-cost analyses computed for 75 cities are given to illustrate that such data might find effective use for estimating and checking.

A cooperative venture

In the preparation of this survey, the editors of *Engineerings News-Record* acknowledge with appreciation the cooperation of more than 300 municipal engineers and public-works directors who supplied data. Their painstaking efforts to consolidate available information on refuse disposal practice reveals a sense of justifiable pride in what they have accomplished and may point the way toward even higher standards in one of our most important public services.

UNIT COSTS FOR REFUSE COLLECTION BASED ON DATA FROM 75 CITIES

Size of City — Population	Number Represented	Cost-per-year-per-capita — Max.	Median	Min.
Over 1,000,000	1	$0.633	$0.633	$0.633
250,000-500,000	7	2.059	1.344	1.064
100,000-250,000	11	3.080	1.236	0.436
50,000-100,000	13	5.027	1.801	.285
25,000- 50,000	21	3.472	1.230	.600
10,000- 25,000	22	2.945	.961	.171

Model Tests Help Navy Choose Breakwater Design

Model studies of a proposed breakwater for the harbor at Hunter's Point, Calif., led to selection of a design which promises effective protection for the docks and minimum expenditures for future dredging. The University of California made the studies for the Navy's Bureau of Yards and Docks. Three governing conditions were: (1) that the breakwater protect the piers against waves more than 2 ft. high; (2) that it cause no excessive tidal currents across the entrances to the docks; and (3) that it control the tidal currents to keep the harbor clear of sand bars without deep scouring of pier foundations. All three effects were studied by means of the models.

A ripple tank with a lucite bottom served for the pilot study on wave action. Shadowgrams made by photographing the ripples from beneath the lucite bottom showed the action of the breakwaters in stopping waves. A motor-driven paddle produced ripples to scale size.

Wave experiments were repeated and verified in a larger tank used for all other tests.

In the larger tank, the harbor model was built to a vertical scale of 1:100 and a horizontal scale of 1:600. Proportionately greater depth was used to reduce the effects of viscosity and surface tension. For varying the depth, the bottom of the tank could be moved vertically.

Two inflow gates from a common forebay and two outflow gates controlled water movement in the model to correspond with tide cycles measured in the prototype harbor. A complete tidal cycle in the model took 13 min.—6 min. 10 sec. for flood and 6 min. 50 sec. for ebb. Water surface in the model was restored to the same datum at the start of each cycle.

Gate regulation for the ebb and training walls for the flood tide controlled current velocities in the model to correspond with observations recorded at special stations.

By scattering confetti on the surface and taking photographs, the experimenters obtained pictures which both showed the direction of currents and measured the surface velocities. As all photographs were made with a standard exposure time, the length of the confetti streaks gave an accurate comparison of velocities.

First tests determined the length of breakwater and the effective shapes to give protection from waves. The experiments then proceeded to test the various shapes with respect to their effect on cross currents at the entrances to the docks.

In the final series of tests, studies again were made of the various shapes to learn how they would influence tidal currents (1) to avoid deep scour around foundations and (2) to prevent formation of sandbars.

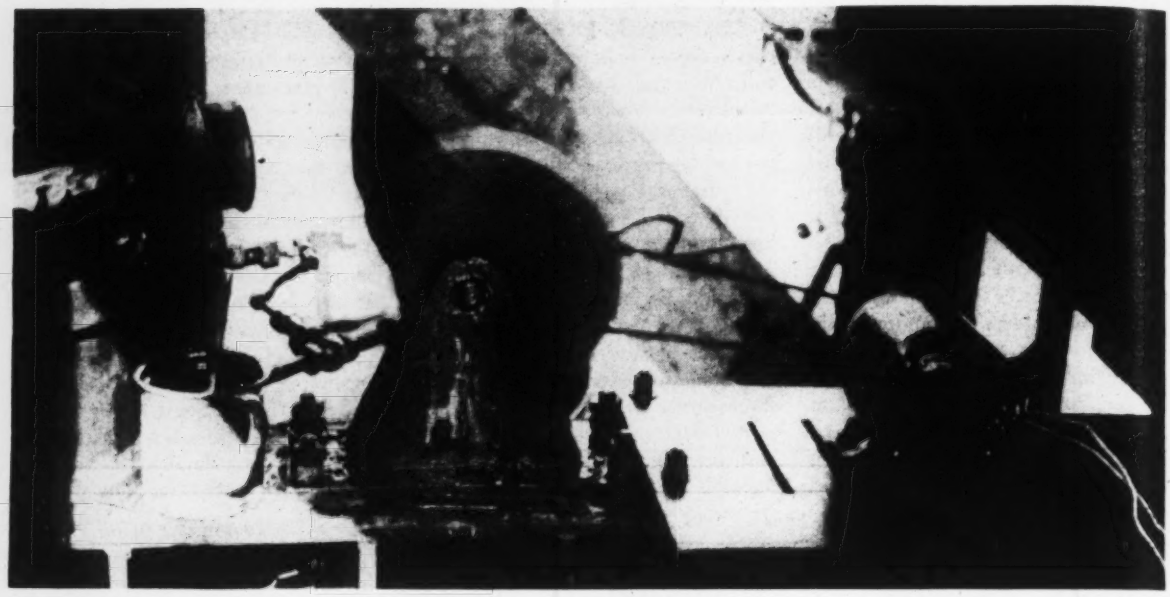


Fig. 1. Job-made machine for vibrating piles under test was an eccentric-mounted plate rotated by a variable-speed motor.

Vibration Testing of Friction Piles

C. F. Dodge
General Electric Realty Corp.
Schenectady, N. Y.

W. F. Swiger
Stone & Webster Engineering Corp.
Boston, Mass.

***Contents in Brief**—Vibration tests on several types of friction piles in granular soils showed settlement in addition to that caused by static loading. A definite resonant frequency of the piles was found at about 600 rpm. causing a vertical amplitude of motion around 0.004 in. A concrete pile with an enlarged bulb bottom had an amplitude of 0.001 in. and settled least of all piles tested.*

VIBRATION, long suspected of being a cause of foundation settlement, was definitely proved to cause further movement of loaded friction piles in recent tests at the Schenectady, N. Y., plant of the General Electric Company. Settlement of foundations, attributed to vibration from heavy crane movement, has caused tilting of precision tools and has required releveling of turbines and generators while under test.

When a new plant was planned in an area where damaging settlements had occurred, the effect of vibration on loaded piles was studied by vibrating at different frequencies several types of piles while under test load. The primary information sought was the *additional* settlement that would occur after settlement from static loads had ceased.

The new structure, a $20,000,000 plant for manufacture, assembly and testing of turbines, is 640x1,280 ft. in plan. It is designed for extremely heavy loads, including two levels of overhead cranes—one carrying 100 tons and the other 200 tons—both supported on the same columns. Precision machine tools are located throughout the building, and there is a test area that will accommodate complete generator units up to 200,000 kva. with a concentrated weight of as much as 500 tons.

Test borings showed the top 30 ft. of the soil underlying the site to be mostly fill, consisting of sand, gravel, cinders and miscellaneous refuse. Under the fill is a layer of soft, sandy clay of variable depth, which contains considerable organic material. Under this organic clay are intermingled fine silty sand and sandy silts as well as fresh water clays of variable compressibility and thickness, all deposited by the Mohawk River in recent geologic times.

Below this is hardpan, a mixture of clay and sand with some gravel, which varies in depth from 5 to 20 ft. The depth of these various types of soil varies from 90 to 120 ft. overlying thinly bedded dark gray shale. The shale is well indurated, shows no sign of weathering, and, at the site is nearly horizontally bedded.

Void ratio determinations made from samples obtained from Shelby tube samples showed these sands to be in a medium-loose condition. Also, while the soils are quite intermingled, the individual strata are composed of soils of very uniform

size. Theoretically these are conditions favorable to settlement under vibration.

In such non-cohesive soil, vibration is known generally to result in increasing the density of the material. In loose soils, vibration may cause appreciable changes in volume. Below groundwater level, since the pore spaces between individual soil grains are filled with water, densification of the sand by vibration must be accompanied by a flow of water out of the soil. The usual direction of flow is upward and the quantity of flow may be sufficient to lift and loosen the soil, causing a temporary quickening or quicksand condition. The effect of this quickening of sand soil in pile foundations is to reduce friction between the soil and the pile, and thus decrease the load-carrying capacity of piles of types that depend upon skin friction for their support.

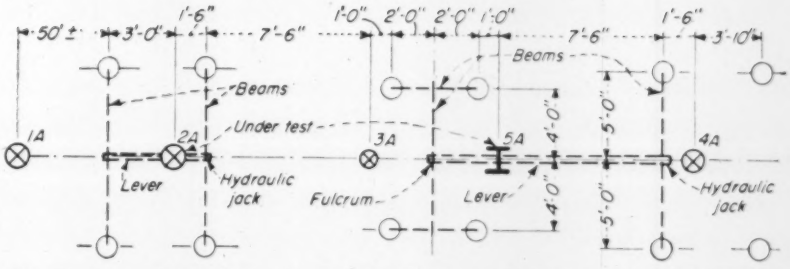


Fig. 2. Arrangements for testing piles in Group A—Pile 1A was a cased concrete pile used as a bench mark; 2A was cased concrete, button-bottom pile driven from the surface at El. 228 to El. 172; 3A was 10¾ in. o.d. concrete-filled pipe driven to hardpan at El. 100; 4A was composite pipe and cased concrete driven to El. 158; and 5A was 12-in. WF, 65 lb. driven to hardpan at El. 103. Open circles show uncased pedestal piles driven to El. 181 and used for reaction in testing.

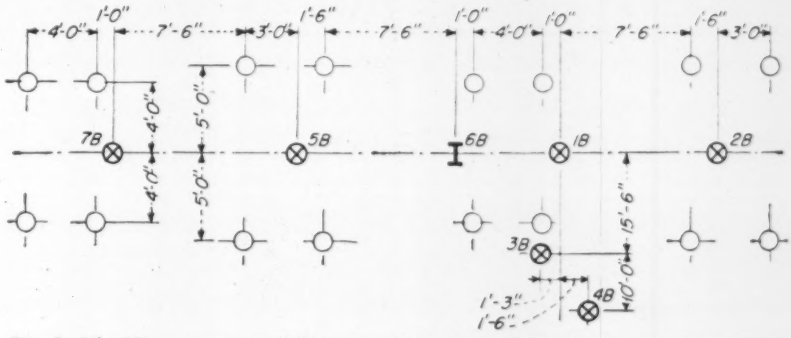


Fig. 3. Pile 1B was concrete filled pipe driven from surface at El. 224 to hardpan at El. 133; 2B, composite pipe driven to El. 159; 3B, closed-end pipe pulled in friction test; 4B, cased concrete used for bench mark; 5B, composite wood and cased concrete; 6B, 12-in. H, 53 lb. driven to hardpan and pulled to examine effect on tip of hard driving; 7B, cased concrete pedestal driven to El. 173.

Several types tested

Tests were made on two groups of piles, as shown in Figs. 2 and 3. Each group had H-beams and concrete-filled pipe piles driven to hardpan. Button-bottom, pedestal, composite-pipe and cased-concrete, composite-wood and cased-concrete piles were driven to lesser depths for friction and vibration testing.

The button-bottom pile has a 17-in. dia. concrete button driven with a 14-in. o.d. pipe having a ½-in. thick wall. After driving, a 12-in. corrugated shell was dropped inside the 14-in. pipe to hold concrete for a stem and the pipe was withdrawn. The same method was followed in driving pedestal piles. After the 14-in. pipe, closed with a concrete button, had been driven to the desired elevation, 8 to 12 cu.ft. of concrete was placed in the pipe and driven down with a 12-in. dia. core as the pipe was pulled up until the bottom of the core and casing were at the same elevation. Core and casing were then driven down on the concrete, forcing it out into an enlarged bulb. The core was withdrawn and a corrugated shell dropped into the casing to rest in the concrete. The shell was filled with concrete to form the pile and the casing pulled.

The composite pipe and concrete pile was made by driving a 10¾-in o.d. pipe through a 14-in. pipe and a 12-in. corrugated shell was used at the top to replace the 14-in. casing. The wood and concrete pile was made similarly by driving the wood pile inside the already driven 14-in. pipe and topping it also with a corrugated shell filled with concrete.

STOP AND GO

Interesting information on the effect of stopping hammer operations for varying periods was obtained as an incident to the pile driving in sandy soils for the turbine building for General Electric. On steel H and pipe piles, tests indicated that the stopping of driving for overnight or longer resulted in about doubling the driving resistance for the first few inches of penetration after resumption of driving. This temporary freeze dissipated quickly and normal variable driving conditions followed. Pauses of about an hour's duration had little or no effect on driving resistance. Fig. 4.

Despite anticipated hard driving through the interbedded fine sands and silts, all the piles drove easily. It was expected that jetting would be necessary to found the H-piles in hardpan, but all four long H-beam and pipe piles were driven without jetting. Jetting was tried, but with a 1-in. orifice and water at 250 psi, it was not possible to penetrate more than a few feet into the sand and silt strata. It is probable the jet was stopped by the occasional thin stratum of heavy gravel.

Foot-by-foot driving records, Fig. 4, showed erratic driving resistances, piles driving moderately hard one foot and easily the next. Furthermore, the driving resistances did not increase with increasing penetration into the founding strata as usually is found resulting from the cumulative build-up of friction between pile and soil. These conditions indicated that driving resistances were primarily dependent upon end bearing rather than friction between the piles

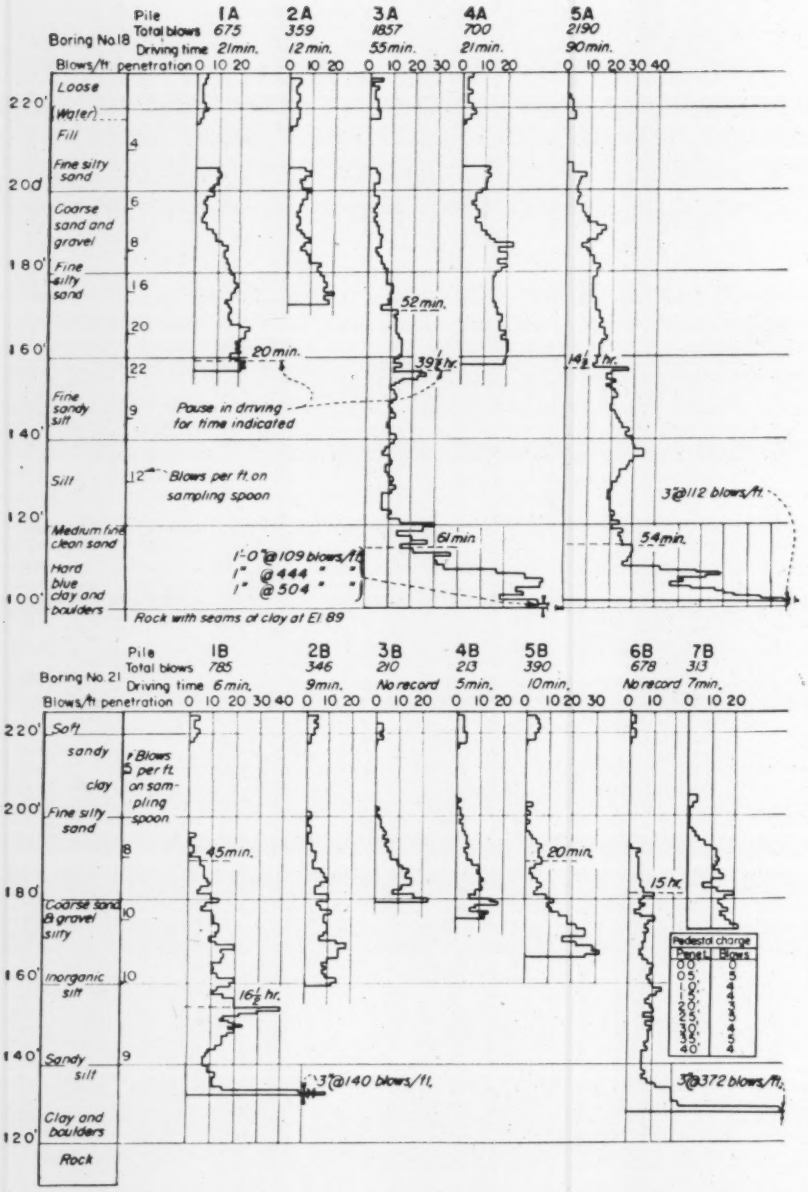


Fig. 4. Foot by foot driving record of piles tested for G. E. turbine building construction. For type of pile and location see Figs. 2 & 3.

and soil. For the friction piles, computation of ultimate bearing values by the Hiley formula based on final observed driving resistances indicated values less than the test loads actually placed on the piles, yet failure—as evidenced by excessive or continuing settlement—was not reached in tests of any piles.

Uncased pedestal piles of concrete were driven to take the reaction of other piles in testing. These were made similar to the pedestal pile driven for testing but the 14-in. casing was filled with concrete and withdrawn, leaving a pedestal pile of uncased concrete formed in the ground. Prior to placing concrete above the bulb, reinforcing rods were inserted in the bulb and extended to the surface to take the tension reaction of testing.

Piles were test loaded to not less than 2½ times anticipated design loads by a system of levers and hydraulic jacks reacting against a welded steel framework held down by reaction piles. The arrangement of the test groups was such as to permit the use of six hold-down piles when load-testing each pile driven to hardpan, and four hold-down piles for each of the friction piles. Settlement of the piles was measured on dials, reading direct to 0.001 in.

A comparison of settlement of bearing piles driven to hardpan is shown in Fig. 5 and of friction piles, including the pedestal pile 7B, in Fig. 6. These graphs show moderate settlement for all piles. Settlement of the pipe and steel H-piles driven to refusal in the hardpan were less than the elastic deformation of these piles computed as end bearing columns, indicating that some portion of the loads imposed upon the pile was supported by friction in the silt and sand strata overlying the hardpan. Residual settlements of piles after release of load were very small.

The pedestal pile 7B showed less settlement under load than any of the other friction-type piles, even though driven to a lesser penetration into the load-carrying strata. This pile, which was loaded to a maximum of 253 kips, compared favorably in settlement characteristics with the pipe piles driven to refusal.

Effect of load and vibration

To establish the effect of vibration, piles 4A, 2B, 5B and 7B, were subjected to vibration while being held under constant load. The time-settlement curves of these piles while under load and vibration are shown on Fig. 7. For each test the pile was brought to the desired load and the load held. After settlement under this load had ceased, the piles were vibrated for periods varying from 9 to 16 hours.

The vibrating device was a 1-in. plate, 12-in. in diameter, mounted with an eccentricity of 1 in. and rotated at a variable speed by an electric motor. The vibrator was operated at a frequency of about 800 r.p.m. when testing pile 4A, the first pile vibrated, which showed a vertical amplitude of motion of about 0.0015 in. Vibration amplitudes were measured at the pile head using a dial gage reading direct to 0.001 in. while independently supported and so arranged as to measure the vertical motion of the pile head.

Subsequently the equipment was modified to permit operation at vari-

able speed. Experiment indicated definite resonant frequencies of operation for each pile at which vibration of the pile head was at a maximum. The remaining piles were vibrated at their resonant frequencies. The resonant frequency of the composite concrete pile 2B and of the composite wood pile 5B was about 500 r.p.m. The vertical amplitude of motion for these piles at resonant frequency was about 0.0035 in. for pile 2B and about 0.005 in. for pile 5B. The pedestal pile 7B had a resonant frequency of about 600 r.p.m. and a maximum amplitude of motion of about 0.001 in.

Operation of the vibrators on the piles at variable speeds indicated sharp peaks of resonance. For example, on the pedestal pile, resonant frequency was about 600 r.p.m. Operation of the vibrators at 500 r.p.m. or at about 850 r.p.m., that is, below or above the resonant speed, indicated amplitudes of motion less than one-quarter of the maximum. This range of speeds was chosen because it was found to provide the greatest resonant speed and amplitude of motion at that speed and indicated that maximum vibration of the piles was at the resonant speed.

Assuming that the settlement of piles under vibration results from a reduction in friction on the part of supporting strata, the rate of settlement of loaded piles under vibration should be dependent upon the load carried by the piles. As shown by Fig. 8 the rate of settlement under vibration of pile 2B was much greater at 120 kips load than at 60 kips. However, the test at the 120-kip load was made first.

Piles 4A, 2B and 5B, all friction piles, showed settlements under vibration at about 50-kip loads, while 7B, a pedestal pile, showed no settlement within the duration of the test period under vibration at 123-kip load. It should be noted that pile 7B was driven to appreciably less penetration into the load bearing stratum than any of the other piles tested.

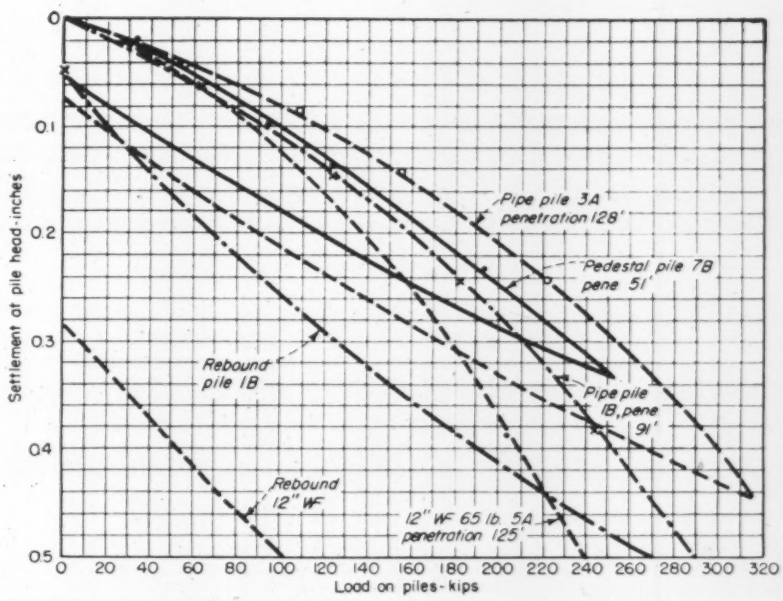


Fig. 5. Comparison of piles driven to hardpan. See Figs. 2 and 3 for location and description of individual piles.

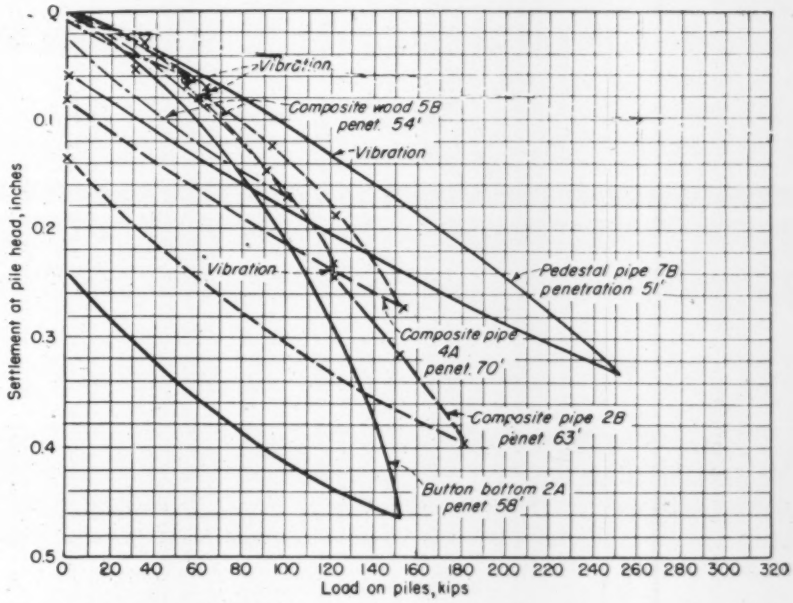


Fig. 6. Comparison of load tests on piles driven to friction bearing. See Fig. 2 and 3 for data on the piles.

Conclusion

All friction piles tested showed modest settlement under load. Vibration of friction piles, while under test load, showed a consistent tendency for all types, except the pedestal pile, to penetrate farther into the soil under vibration than when carrying static loads only.

Pedestal piles, with a cased concrete shaft seated well down into an enlarged bulb of concrete, showed better carrying capacity under static load than other friction piles, and showed no effect from vibration. This may have been due to the much larger end-bearing area and resultant less dependence upon skin friction, or to the increased compaction of the soil by driving and forming of the pedestal, or both.

For conditions at this site, it was desirable to obtain the maximum densification of the soil where friction piles were to be used. The pedestal pile was considered the most effective both because of the large cross-sectional area of the pedestal, which caused maximum displacement of the soil near the tip, and the fact that there were two or more periods

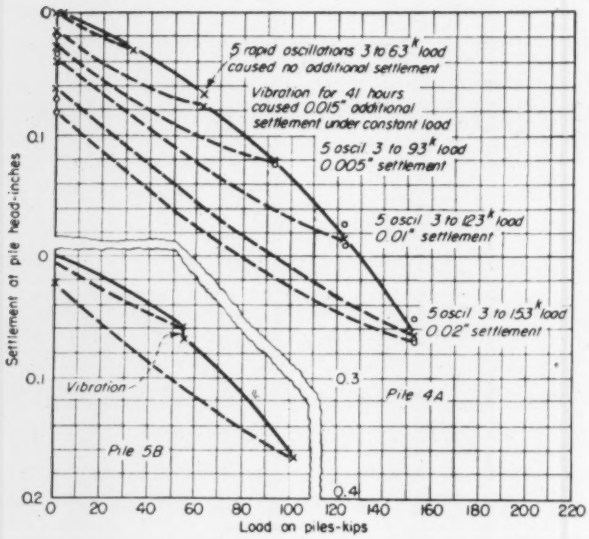

5 rapid oscillations 3 to 63 k load caused no additional settlement
Vibration for 41 hours caused 0.015" additional settlement under constant load
5 oscil 3 to 93 k load 0.005" settlement
5 oscil 3 to 123 k load 0.01" settlement
5 oscil 3 to 153 k load 0.02" settlement
Vibration
Pile 5B
Pile 4A
Settlement at pile head-inches
Load on piles-kips

Fig. 7. Effect of applying and releasing load up to 150 tons on Pile 4A. Inset drawing shows effect of short vibration on a composite wood and concrete pile at light load.

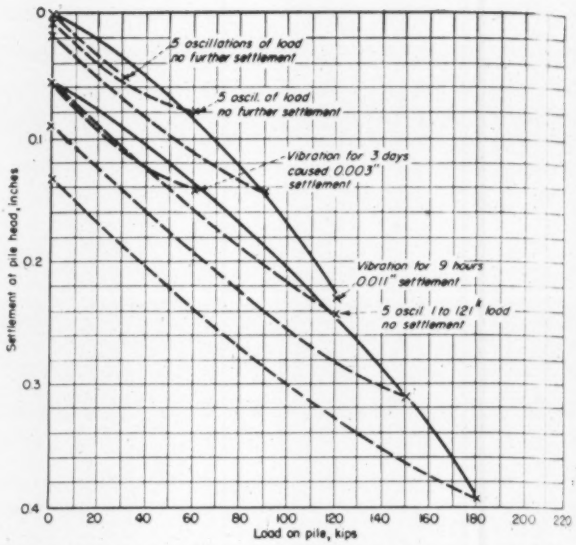

5 oscillations of load no further settlement
5 oscil. of load no further settlement
Vibration for 3 days caused 0.003" settlement
Vibration for 9 hours 0.011" settlement
5 oscil. 1 to 121 k load no settlement
Settlement at pile head, inches
Load on pile, kips

Fig. 8. Effect of rapidly loading and unloading composite pipe pile 2B then vibrating and again oscillating the pile at different loads.

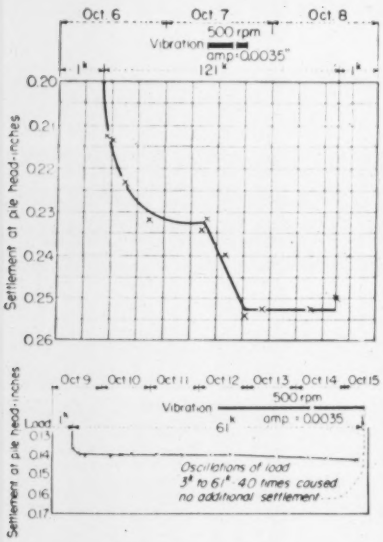


Fig. 9. Effect of vibrating composite pipe pile 2B for considerable periods under constant load. Note that 121-kip load was applied first and subsequent 61-kip load showed only minor movement.

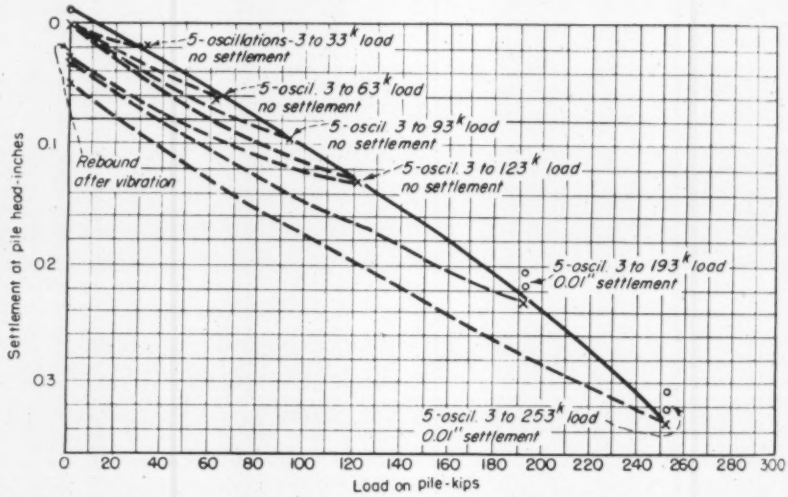

5-oscillations-3 to 33 k load no settlement
5-oscil. 3 to 63 k load no settlement
5-oscil 3 to 93 k load no settlement
Rebound after vibration
5-oscil. 3 to 123 k load no settlement
5-oscil. 3 to 193 k load 0.01" settlement
5-oscil. 3 to 253 k load 0.01" settlement
Settlement at pile head-inches
Load on pile-kips

Fig. 10. Oscillation test results on cased concrete pedestal pile 7B driven to only 52 ft. penetration.

of driving on the soil at the same elevation.

Since, however, settlement of piles from vibration is dependent upon the soil conditions rather than the type of piles, it is believed that the evidence that pedestal piles are not subject to settlement under such conditions is misleading. It seems more probable that the rate of settlement of the pile tested was reduced to a point where it could not be determined in short time tests, especially where using a small vibrator, such as was used in order to produce conditions reasonably approximating the vibrations which might arise in the building. Only piles or caissons passing completely through the silt and sand strata and founding on the underlying rock or hardpan are believed to be free from settlements resulting from vibration in these soils.

Steel H-piles to rock or hardpan were used for the support of precision equipment or machine tools for the turbine test platforms and other locations where differential settlements had to be minimized, and for the support of the heavy crane columns where they were more economical. Pedestal piles were used under the office building, some of the machine tools, and for the more lightly loaded crane columns. Machine tools especially susceptible to vibration or causing excessive vibration were isolated, and crane rail joints were welded and ground to minimize vibrations.

Design and construction of the turbine plant where the foundations described are used is being done for the General Electric Realty Corp. by Stone and Webster Engineering Corp. Driving of the test piles and the 4,676 H-piles and 1,738 pedestal piles required for the building was done by Western Concrete Pile Co.

Limit Design of Prismatic Beams

Egor Paul Popov
Asst. Professor of Civil Engineering, University of California
Berkeley, Calif.

Contents in Brief—Limit design, or design based on the actual load-carrying capacity of a beam for static loads, not only appears to be more logical than the conventional method based on the elastic theory, but will conserve materials. For continuous beams, the saving is made through utilization of continuity and of the carrying capacity beyond the yield point of some parts of the member. To demonstrate this, limit design is applied to several prismatic continuous beams.

BEAMS are not designed consistently for static loads when a factor of safety based on a ratio of stresses is applied. Design more logically should be based on the load-carrying capacity of members predicated on excessive deflections, instability or collapse. If this were done, considerable saving of material would result.

The real factor of safety for strength criteria is the ratio of the load at the ultimate capacity of a member to the design load. But the ultimate carrying capacity of a beam —excluding situations where deflections govern—derives such capacity with stress distribution drastically different from the one demanded by the elastic theory, which assumes stress proportional to strain. Thus, the ratio of stresses, contrary to the usual practice, does not indicate a correct factor of safety.

Stresses beyond the elastic range

Tests show that, for loads imposed on a steel beam causing stresses far beyond the elastic ones, plane sections through the beam remain essentially plane. Thus, as indicated in Fig. 1, associated with the linear strain variation in the region beyond elasticity is a non-linear stress distribution.

For flexure, the neutral axis is found by the usual process of summation and equating to zero of the forces normal to a section. The resisting moment is found by summation of the moments of these forces about the neutral axis. (For more details, see S. Timoshenko, *Strength of Materials*, Part II, 2nd Edition, 1941, pp. 362 to 379).

To determine the ultimate resisting moment, consider a relatively slender steel beam, say with third-point loading. For simplicity, it will be assumed to have a symmetrical section, thus avoiding the shift of the neutral axis with increase in load, as would be the case in a T-beam, for example.

If the load is gradually increased, the maximum deflection will be proportional to the load until the yield point in the extreme fibers is reached. After this, strains continue to vary linearly, but stresses do not. With increasing load, the stress distribution will be progressively as shown by lines a, b and c, in Fig. 2.

A plot of load versus deflection is shown in Fig. 3. Such diagrams are supported by experimental evidence. From the figure, it can be seen that after an appreciable amount of yielding in the fibers, the steel hardened and the beam carried some additional load. However, at this stage, deflections increased with essentially no increase of load (or moment) and were so large compared to elastic deformations that they cannot be tolerated in any structure.

Curve gives ultimate capacity

Also, in the usual designs with material concentrated in the flanges, a large amount of ductile elongation cannot take place because the flanges may become unstable. Hence, in the usual case of a rolled or built-up section, the theoretical curve beyond point B in Fig. 3 does not exist. The ultimate carrying capacity of a beam may then be taken as that corresponding to the ordinate of the curve at B. The resisting moment remains essentially constant for a large amount of plastic flow.

Ultimate resisting moment computed

Determination of this value is simple if we make an additional approximation—substitution for curve c in Fig. 2 of a rectangle. This may be done because the forces near the axis contribute very little to the resisting moment. The ultimate resisting moment M_u of a symmetrical section is then

$$M_u = 2Ayf_y$$

where A is the area of the section above the neutral axis, y the distance to the centroid of this area and f_y the yield point strength of the steel in simple tension.

This moment can be calculated more readily from beam constants now in common use through its relationship with the moment at the beginning of yielding M_y, which is found by the elastic theory to be

$$M_y = \frac{I}{c} f_y = Zf_y$$

I and c have the usual meaning of moment of inertia and distance from the neutral axis to the extreme fiber, respectively, and Z is the section modulus. The ratio k of M_u to M_y is the property of a section and may be called the form factor. Always greater than unity, it is 1.5 for a rectangle, 1.7 for a circular section, about 2 for a diamond (depending on proportions), and varies between 1.1 and 1.5 for I-beams, wide-flange sections and channels. A complete chart for the latter group is available. (E. Mirabelli, Structural Application of Steel and Lightweight Alloys—A Symposium, Discussion, *Transac-*

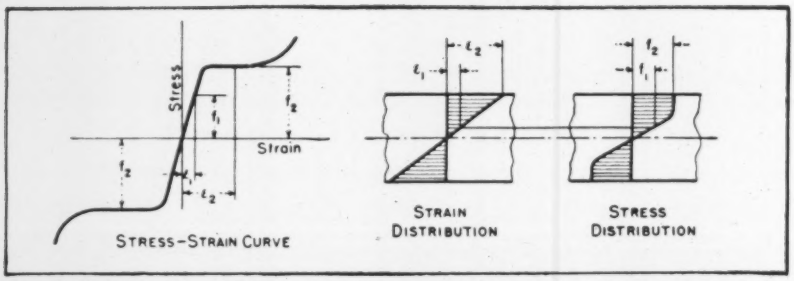


Fig. 1. Strains in a steel beam may be assumed to vary linearly, even beyond the elastic limit, but, as indicated at the right, not stresses.

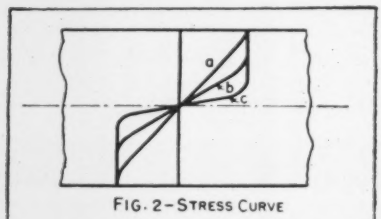


FIG. 2–STRESS CURVE

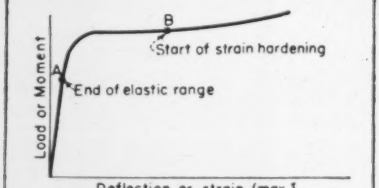


FIG. 3–LOAD–STRAIN CURVE

Figs. 2 and 3. Stress distribution curves for a steel beam at and beyond the elastic limit are shown in the upper diagram. The relationship between loads and strains is plotted below.

tions, ASCE, 1937 p. 1402). Thus, the ultimate resisting moment is given by

$$M_u = k Z f_y$$

From this—since moments are in general proportional to load—it follows that for a simply supported steel beam, a much better approximation of the safety factor is $k f_y/f_a$, where f_a is the allowable stress. Thus it can be seen that use of a safety factor based only on the ratio of stresses results in an unduly conservative design.

Limit design of continuous beams

The application of this concept to continuous beams is even more striking. In pre-war central Europe, it was called *Traglastverfahren*, or the carrying-capacity method. It became more widely known in the United States after presentation by Professor Van den Broek (Theory of Limit Design, *Transactions*, ASCE, 1940, p. 638) in 1940, and the method has been aptly named limit design.

The use of this method has been reflected in certain building regulations and has been discussed in several periodicals (Final Report of the Second Congress, International Association for Bridge and Structural Engineering, 1939, p. 27). A description of it also appears in several standard Russian text books (such as N. M. Belajev, Strength of Materials, 4th Edition, 1945, p. 476).

As an example of the application of limit design, consider a two-span prismatic continuous beam with loads at midspan (Fig. 4). The moment diagram for elastic action is shown at (b).

As the loads are increased, yielding occurs over the middle support. Nevertheless, the beam remains serviceable. With further increase in the loads, a plastic hinge, capable of attaining resistance of M_u, forms over this support, and more moment becomes available to be carried under the loads. Thus, the beam will collapse only when the moments at midspan also reach M_u, or when three hinges per span become available. Since, for collapse of a continuous beam, equal moments must form at points in the spans and over the supports, the method has also been called equalization of moments method.

The moment for limit design, from Fig. 4(c), becomes AC − BC = DE, or $PL/4 - M/2 = M$, from which $M = PL/6$. Hence, the required section modulus before application of a safety factor is $Z = PL/6\ k\ f_y$. By the elastic theory $Z = 6PL/32\ f_y$, which is $9k/8$ times larger.

As another example, consider the same beam with a concentrated load in only one span (Fig. 5). The moment diagram for elastic action is shown at (b).

In this case, unlike the former, the hinge will form first at midspan. With increase in load, more moment is taken by the section of the beam over the support, and collapse occurs only when M_u is also reached there. The limit-design moment is again $PL/6$, as may be seen from Fig. 5(c).

In this case, a comparison with the section modulus required by the elastic theory indicates that the latter is $78\ k/64$ times as large, a ratio more favorable to limit design than the one obtained in the previous example. The higher ratio results from greater unbalance of elastic moment. In general, greatest savings through use of the theory of limit design are indicated for cases where there are large differences in elastic moments.

Solution simplified

Other pertinent observations can be made from inspection of the previous examples. For example, the limit-design moment is the same for both cases, and the sequence of hinge formation is immaterial. These facts lead to a simple procedure for determining the limit-design moments of continuous beams of constant cross-section. One first indicates the simple-beam moment diagram for each span. Then, a closing line for the negative moments is drawn (or calculated) for each span so as to equalize the positive and the possible negative moments.

The use of this technique is illustrated in Fig. 6. Here, a concentrated load is acting in one span and a uniform load in another. Simple-beam moment diagrams are drawn as in Fig. 6 (b), and then we proceed to examine the left span for the critical conditions.

By drawing the closing line ABC in such a way as to have segments BD and EF equal, we find the design moment as governed by the loading in this span to be $PL/6$. At the limit load, hinges would occur under the load and over the middle support.

Then, we examine the second span. The closing line AGC must be such as to make GD equal to HJ as in Fig. 6 (c). The limit-design moment for the right span is found to be $wL^2/12$.

Since each span behaves independently in the ductile philosophy of design, because once M_u is reached

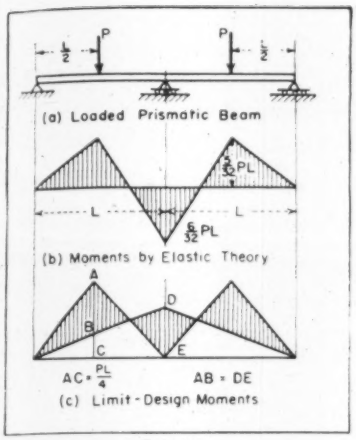


FIG. 4

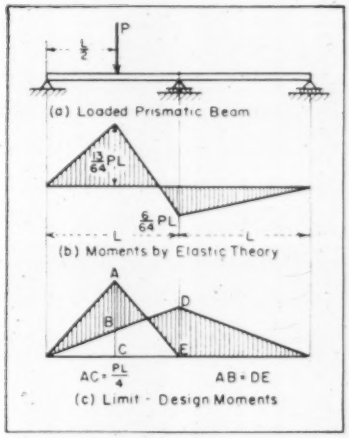


FIG. 5

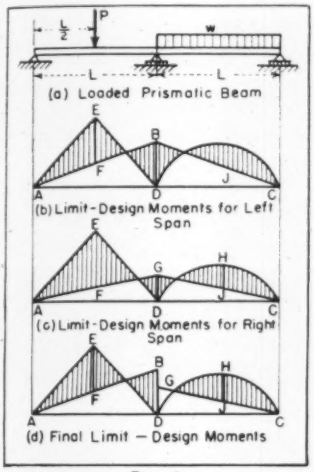

(a) Loaded Prismatic Beam
(b) Limit-Design Moments for Left Span
(c) Limit-Design Moments for Right Span
(d) Final Limit — Design Moments

FIG. 6

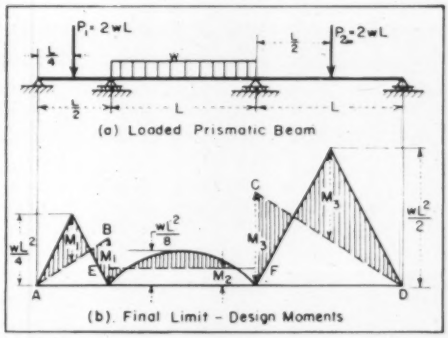


FIG. 7

NOTE: Method of determing limit-design moments illustrated here closely follows N.M Belajev, Strength of Materials, 4th Edition, Moscow, Leningrad, 1945

Figs. 4 to 7. Examples illustrating the determination of limit-design moments in prismatic continuous beams by making positive and negative moments equal.

over the support the effect of the adjoining span is blocked off, the two steps outlined above may be combined, and in practice only the diagram in Fig. 6 (d) needs to be drawn. Here, after the simple-beam moment diagrams have been drawn, AB and GC are determined to make EF = BD and GD = HJ. The larger ordinate governs the design. Thus, in Fig. 6, BD represents the critical condition, and the required section modulus would be found in the usual way from $Z = PL/6k\ f_a$.

As a last example, let us consider the prismatic continuous beam with the loading shown in Fig. 7. First, the simple-beam moment diagrams are drawn. Second, the closing lines AB and CD, as in the previous example, are shown. Third, a horizontal line EF for the interior span is drawn so as to equalize the moments over the supports and the maximum positive moment. The limit-design moments then become $M_1 = wL^2/6$, $M_2 = wL^2/16$, and $M_3 = wL^2/3$, where subscripts refer to the various spans. The moment in the third span governs the selection of the continuous beam.

The analyses presented here may be extended to situations where beams of variable moment of inertia are used. Also, much may be said about fluctuating loads that do not cause complete reversal of stress. But neither of these topics comes within the scope of this article.

Concepts not universally accepted

Attention is called to the fact that the hypothesis of gradual plastification of hinges as presented in this discussion is contested by some. The dissension is based on apparent observations of a higher yield point in flexure than in pure tension. It assumes that under-stressed material inhibits yielding of adjacent higher-stressed fibers. Consequently, the conclusion is reached that a sudden plastification of the beam occurs (akin to delayed boiling, or turbulent and laminar flow). However, despite the differences in hypotheses, the ultimate capacity of a beam calculated on either basis is very nearly the same.

More serious objections to the method presented arise in cases where heavy shears occur. No adequate new solution is available for such situations. Another objection applies to cases involving unusual span ratios. For example, in a beam with two long side spans and a very short middle span, complete equalization of moment under the load in the middle of the short span and over the adjoining supports has been shown to be difficult to attain. The method must not be applied where complete reversal of stress occurs.

In this discussion, a simplified picture was presented showing how the ever-present ductility of steel can be turned to advantage in design. The method adopted no doubt oversimplifies the real problem, yet, it has consistantly shown better agreement with tests than the usual elastic methods. It promotes greater consistency of design and economy. It also, last but not least, is unusually simple to apply to highly indeterminate constructions.

Basementless Houses Found to Cost Less

A basementless house with an "ell" for utility and storage purposes can be built at a cost equal to or less than a house with basement and will provide a definite increase in relative convenience. This is the conclusion of a comparative study appearing in Technical Bulletin No. 3, issued by the Housing and Home Finance Agency.

If the basement is eliminated, additional space must be proveded above ground for storage, for heating and laundering equipment, and for other facilities. The additional space, the article explains, may be supplied either by adding a utility or service "ell" or by expanding the overall size of the house.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Longest Continuous Span

Sir: In further reference to the Admiral Graf Spee Bridge over the Rhine at Duisburg-Rheinhausen (*ENR* March 4, 1948, vol. 140, p. 373; April 15, 1948, vol. 140, p. 582), it should be noted that this was a two-span continuous truss (of the Double-Warren type with subdivided panels), and that the span lengths were 503 ft. and 839 ft. (not 850 ft.). This was for seven years (1935-1942) the world's longest continuous truss span.

The prior outstanding record had been held for eighteen years (1917-1935) by the Sciotoville Bridge over the Ohio River, with two continuous spans of 775 ft. each. In 1942 a new record was established by the completion of the continuous truss bridge over the Mississippi River at Dubuque, with a central span of 845 ft.

The succession of record span-lengths of continuous trusses is recorded in the following tabulation:

Year	*Bridge*	*Location*	*Span*
1888	•†Lachine	St. Lawrence R.	408
1908	•Fades Viaduct	France	472
1917	•Sciotoville	Ohio R.	775
1935	†Duisburg	Rhine R.	839
1942	Dubuque	Mississippi R.	845

(•Railroad Bridge. †Not Standing.)

D. B. STEINMAN
Consulting Engineer
New York, N. Y.

Flat Slab Design

Sir: It seems appropriate to call the attention of structural engineers to the fact that the basic formula, $M_o = 0.09WL$, for the design of flat slabs provides for a two-way slab-band design. The column bands are designed as continuous beams, in which the clear span is used.

The clear span of the column bands is $L - \frac{2}{3}$ of the diameter of the column capital. If the column capital has the usual diameter, $0.225\ L$, the clear span used in the design becomes $0.85\ L$, and the moments in the column bands are as follows—Negative moment at the support: $W \times 0.85L/24$ and positive moment at mid-span: $W \times 0.85L/48$, in which $W = w \times L \times 0.85L$

The above moments apply only when the slab is uniformly loaded over its entire area and the panels are square. In other words they are column band moments for the condition of fixed ends in square panels. For any other condition, it is necessary to apply approximate empirical methods or the more realistic approach of approximate elastic analysis. In this connection the writer is deeply grateful to Professor Hardy Cross for furnishing us with that very useful tool, moment distribution. It has made life easier for structural engineers.

WALTER H. WHEELER
Consulting Engineer
Minneapolis, Minn.

Swimming Pool Design

Sir: The article "Engineered Design of Swimming Pools (*ENR*, Dec. 1947, vol. p. 870), covers the subject effectively although the analysis of pool size for a typical city of 35,000 might require further explanation. When a new pool is considered, the existing swimming facilities in the city as well as those within a 20-mile radius should be taken into account. It is then possible to determine some sort of swim-conscious factor and to select the proper pool size for that community.

In this article, a pool to accommodate 3,500 swimmers on a peak-load day apparently has been assumed. This would be correct for all of the swimming facilities in the vicinity but it might be a bit heavy for a new or proposed pool. Another angle is that, even though bathers are in the pool for only a limited time that they are in bathing suits, as much as 75 percent of the peak daily load would be present between 2:00 and 4:00 p.m. This assumes, of course, that sufficient deck-and-play area would be provided to accommodate such a group. In this case it would be a visable to provide bathhouse facilities sufficiently large to handle the greater number of people.

It is not particularly necessary to provide for 100 percent load in a bathhouse. Such a provision would add greatly to first cost and the entire bathhouse probably would not be used more than ten to fifteen times during an exceptionally good season. If the pool is built in a community where swimmers come in bathing suits, the larger bathhouse capacity is not required. Also, on peak-load days, it is often possible to get the bathers to double up on bathhouse facilities.

The article includes a statement that extensive experiments have shown that a filter plant operated at night (when the pool is not in use) is only partly effective because of inadequate removal of the suspended particles. This may be true in the ordinary type of pool but in those equipped with forced recirculation (water injected into the pool adjacent to and parallel with the floor under slight pressure), nighttime operation is very effective. Currents created in lower strata along the floor guide precipitated matter to the main drain. If the recirculating system is properly designed, the equivalent of bulk removal might be obtained. Under certain conditions, such circulation might be more effective than when the pool is in use.

When I first applied for patents on my circulating system, I had this action in mind. Throughout the succeeding years I have proved conclusively, to my perfect satisfaction and to the satisfaction of operators and owners who have installed my system, that night filter-plant operation is exceptionally advantageous. This is especially so in the shallow or "wadable" portions of the pool. In a number of large pools under my supervision that are equipped with this recirculating arrangement, use of a vacuum cleaner on pool bottoms has never been required. The "wadable" areas have been maintained entirely free of precipitated matter.

High filtration rates employed

Another portion of the article states that in no case should the filter rate exceed 3 gpm. per square foot of filter area. I do not agree with this rule

since under my supervision several large pools equipped with pressure filters containing crushed quartz sand operate satisfactory with filter rates as high as 5 gpm. per sq.ft.

In such cases, it has been proven conclusively over many years of operation and on many different sizes and types of pools that special coagulants need not be used. High filtration rates together with elimination of coagulant could not be adapted readily to open-type filters. It would be impossible to tighten filtering material mechanically as may be done with pressure filters that are properly planned for high-velocity operation.

Chlorine dissipated by sun-rays

Another statement refers to excessive release of chlorine caused by the sun's actinic rays during certain atmospheric conditions. The loss due to this action seems to be more pronounced in shallow pools. This statement applies particularly under two conditions: (1) In pools with considerable area less than swimming depth (sometimes provided in very large pools); and (2) in pools into which water is injected near to or at the water surface.

I have also noted that such chlorine losses seem to stabilize at a certain residual. When the chlorine residual is such that it is carried much higher than what is considered the stabilizing point, chlorine dissipation seems to be much faster.

As the water temperature rises during prolonged summer hot spells, dissipation of chlorine seems to increase. It is, therefore, important to control water temperatures in swimming pools so that they do not get too high.

Various schemes of preventing high water temperatures can be adopted. Pools which are supplied from deep wells can temper their water to insure comfortable bathing.

On one of my large pools (125x250 ft.), warm water was quite a problem. The owner built two 25-ft. diameter islands in the pool and equipped each with a spray system similar to those used in power-plant spray ponds. During the night 1,500 gpm. are passed through these cooling sprays. With this method, water temperature can be held close to 75 deg. F. without much difficulty.

Experience with spray ponds has shown that water temperatures can be lowered as much as 15 deg. if humidity conditions and air currents are favorable when sprays are operating.

Chlorine vs. bromine

With reference to bromine disinfection, I prefer to reserve comment. I have had little experience with this method of water sterilization. However, I was not too greatly impressed with the Illinois Department of Health report on bromine for disinfection of swimming-pool water, particularly so when I compared the results reported with the experience I have had over a period of 25 years with the proper use of chlorine as a sterilizing medium for swimming-pool purposes.

WAYNE A. BECKER
Consulting Engineer
Cincinnati, Ohio

Argentina Drops the Pilot

Sir: The article headed "Argentina Drops the Pilot" in your issue of March 25, vol. p. 455, is interesting.

Those who know from experience might have told General Lord that Argentina isn't looking for North American pilots in anything, especially engineers. They have good engineers of their own. They have proved it.

It is doubtful if Argentina needs engineering advice anyway except on the highest levels.

FRED LAVIS
Consulting Engineer
New York

Building Russian Morale

Sir: I have been interested in reading "Building Russian Morale", *ENR* March 18, vol. p. 417.

While your comments properly answer the Russian criticism, perhaps it might be well to point out the following facts about this particular piece of work:

Train traffic was not interrupted for four hours, as the Russian article stated, but there happened to be a 4-hour interval in the regular schedule of trains and the work was therefore planned to use this time. Had there been half as much time, some other plan of making the closure would have been developed.

The line on which this work was carried out is by no means the most important or the fastest in the United States, although there are some 18 regularly scheduled through passenger trains but only about four freight trains due to the fact that the freight is handled on another route having lower gradients.

I wonder, however, if our Russian critics can show any line, either single or double track, in Russia over which average speeds, including all stops, are more than 50 miles per hour for stretches of 500 to 1,000 miles and on territories on which, like this one, there are gradients as high as 2 percent.

Unless conditions have changed greatly since last officially reported, Russian railways are far behind even though they don't have to use mechanisms which work like "Don Quixote's Rossinante."

R. P. HART
Chief Engineer
Missouri Pacific Railroad
St. Louis Mo.

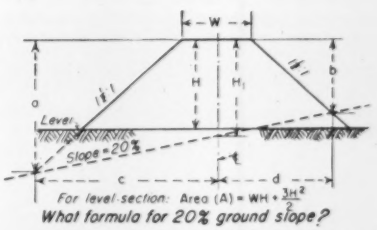
Cut-and-Fill Formula Needed

Sir: Areas for cross sections with side slopes of ½:1 to 1½:1, ground slopes of from 0 to 70 percent, 24-ft. maximum road width and 50-ft. maximum cut or fill may be readily found in a number of tables.

When 42- and 46-ft. road widths are used and cut and fills more than 50-ft. deep are encountered, it is a tedious job to compute earthwork areas for a long highway project.

The area for a section on level ground may be found from $A = WH + \frac{3H^2}{2}$ (see sketch). But what formula should be used, say, for a 20 percent ground slope?

G. P. WYLAND
723 *N. E. Ainsworth St.*
Portland, Ore.



When W, H and H_1 are known, what formula can be used to find the area of section on a 20% ground slope?

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

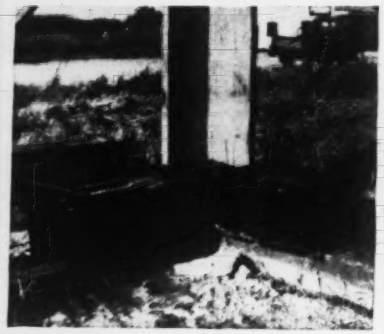


Fig. 1. The hollow concrete walls are built on a solid concrete foundation; a vertical form is used for corners.

Fig. 2. Hollow walls are held together by 1-in. Z-bars. The air space is formed by a central partition.

Fig. 3. Using a minimum amount of water in the concrete, two 9-in. high rings of wall may be poured per day.

Steel Forms Speed Hollow Wall Construction

A steel form for pouring hollow concrete walls in place has been used successfully in the construction of residential buildings in Houston and Beaumont, Texas.

Developed by R. J. Rogers, Dallas builder and structural engineer, the form consists of two 9-in. exterior channels connected across the top and near the ends by means of two adjustable bars which, when shortened by depressing a crank handle, tighten the form against the wall section below and hold the form in place during pouring. Small angles fastened to the bottom flanges provide the necessary grip.

To stiffen the channels and transmit cantilever action, vertical plates are bolted to the bars and welded to the channels. From the middle of the adjustable bar a central form is suspended. This section—made up of two channels with flanges facing inward—forms a 2½-in. hollow space between the 4-in. inner and 4-in. outer walls used for one-story buildings.

Made of 14-gauge steel and fitted with 1-in. steel handles, the forms are manufactured in 60-, 30- and 24-in. lengths so that walls of various lengths may be poured monolithically.

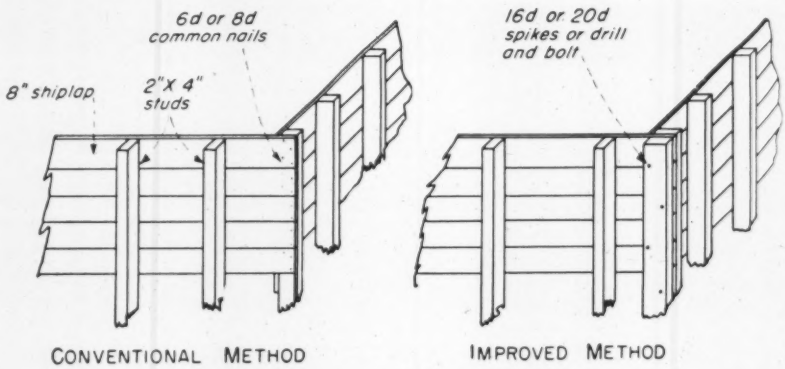
Longitudinally, each 9-in. high wall strip is reinforced with ½-in. diameter bars placed in the center of the layer. Vertically, ¼-in. rods, 12-in. long to extend 3-in. into the layer above, are spaced on 30-in. centers, and horizontally the twin walls are tied together with 1-in. galvanized Z-bars laid 30-in. apart on each completed layer.

The outside forms are designed so that they may be used without the central section to pour solid concrete foundation walls, the hollow walls being started above the ground level.

Using a minimum amount of water in the concrete mix, experience has shown that one band of concrete poured during the morning is set sufficiently by afternoon so that another band can be poured that same day.

The twin-wall construction is reported to have been tested in the laboratories of the University of Illinois and certified as to strength and durability.

Unusual strength due to monolithic construction, improved insulation due to the 2½-in. air space that extends around the entire building, and ease and simplicity of construction are claimed as advantages.—JOHN E. KING 303 *Southland Annex, Dallas 1, Texas*



FASTENING OUTSIDE FORM CORNERS

An extra corner stud held in place with spikes or bolts (right) improves forms for concrete walls by preventing bulging during vibration and board breakage where forms are reused.—JACK H. MAXEY, Durant, Okla.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Engineering Societies

THE ENGINEERING SOCIETIES YEARBOOK: 1948—Published for the Engineers Joint Council by the American Society of Mechanical Engineers, 33 West 39th St., New York 18, N. Y. $3.

Here is a pamphlet that should find its way into every engineer's office once the extent of the information packed into its 95 pages becomes more widely known. Its main lists include the following information about national, regional and local engineering societies: name, year organized, address, type of organization, purposes, number of members in each grade, dues, officers, meetings, divisions, committees, awards and publications. Similar information is given about international engineering organizations and joint organizations such as the Engineers Joint Council, and engineering societies in Canada.

There also is a list, which is recognized as incomplete, of employee organization in the engineering field (other than trade unions), a list of the state boards for licensing engineer, and a tabulation by institutions of the engineering courses accredited by the Engineers Council for Professional Development. A bibliography includes other publications and articles relating to the engineering profession in this country.

An Engineer's Biography

SCIENTIFIC BLACKSMITH—By the late Mortimer E. Cooley. 290 pp. University of Michigan Press, Ann Arbor, Mich. $3.75.

Few engineers have the length and breadth of experience reflected in this autobiography. The author was for more than 40 years on the University of Michigan faculty and for 25 of those years dean of the College of Engineering; he also was active in consulting engineering, in public service and as a leader in the work of engineering societies. The book is replete with anecdotes illustrative of significant points in a long and useful life. There are items of early historical interest concerning the U. S. Naval Academy at Annapolis, from which he graduated in 1878, and of his period of naval service that immediately followed. The two final chapters are devoted to (a) professional societies and (b) the engineer of the future. In the former he suggests a desirable engineers' code of ethics and in the latter he outlines for engineers their future responsibilities. The author's skill as raconteur is manifest all through the book and it is easy to read because of the sense of humor that enabled the author to lean toward the brighter side even when he reached the late 80s, at which age the book was written.

Canal History

THE GREAT NATIONAL PROJECT: A History of the Chesapeake & Ohio Canal—By Walter Sanderlin. 331 pp. The Johns Hopkins Press, Baltimore 18, Md. Paper, $3; Cloth $3.75.

Construction problems of the days before the Civil War, difficulties caused by mixing financial plans and politics and the troubles of canal transportation resulting from competition from railroads all are presented in an interesting manner in this history of the Chesapeake & Ohio Canal. That waterway was started with high hopes of repeating the success of the Erie Canal by providing a trade route through the Potomac River valley to the West. But it was started too late, as the possibilities of railroad construction had already begun to be widely appreciated, and it had to meet much greater physical and political obstacles than its promotors had ever realized.

Although organized as a private stock company, much of the money used for the canal came from federal, state and city treasuries. Construction began in the winter of 1828-29, but the canal did not reach Cumberland, Md., 185 miles from Washington, until 1850 and never did get through the Cumberland Mountains to the Ohio. It was reasonably prosperous during the 1870's, was wrecked by floods in 1889, restored to operation by the Baltimore & Ohio R.R. in 1891 and operated with declining traffic by receivers until 1924 when it was abandoned. In 1938 the B. & O. sold what was left to the federal government.

In sharp contrast to conditions today, many of the rodmen on the early survey work took no pay and paid their own expenses to gain practical engineering experience. And although contractors had no union delegates to deal with, they had many labor difficulties of another sort, including open warfare between rival factions of Irish laborers.

Corrosion Data

THE CORROSION HANDBOOK—Edited by Herbert H. Uhlig. 1188 pp. John Wiley & Sons, New York 16; Chapman & Hall, London. $12.

A large amount of information on corrosion and how to prevent or check it has been brought together for the first time in this handbook, which was written by a large group of specialists under sponsorship of the Electrochemical Society.

For the civil engineer it contains information on classification of soils as to their corrosion characteristics; on behavior of metals in sea water and paints for sea-water exposure; on corrosion in hot and cold water systems; on organic and inorganic coatings to protect metal; and on cathodic protection for tanks and underground water systems.

Limit Design Expounded

THEORY OF LIMIT DESIGN—By John A. Van den Broek. 144 pp. John Wiley & Sons, New York; Chapman & Hall, London. $3.50.

Generally, structural design is based on either the theory of elasticity, which assumes stress proportional to strain, or directly on observations of the performance of components of structures. When the latter method is used, the safe load is computed by applying a factor of safety to the ultimate load. In limit design, ultimate loads are calculated, at least for the less complex structural components, and insofar as the formulas used are correlated with test results, the method is more logical than design based on the theory of elasticity.

Assuming ductile conditions, rather

than elastic stress distribution, the author develops limit design formulas for beams and columns. These apparently indicate that elastic-theory stress analyses, particularly for redundant structures, are often unnecessarily complex and sometimes produce results either excessively conservative or somewhat on the dangerous side.

The arguments presented in this book for using limit design wherever the method is applicable and whenever sufficient data are available appear to be sound. In many cases, engineers who read the book may find that they have on occasion rationalized designs in a similar manner when elastic-theory stress analyses were impracticable.

Hydraulic Text Revised

HYDRAULICS—Fifth Edition—By Horace W. King, Chester O. Wisler and James G. Woodburn. 351 pp. John Wiley & Sons, New York 16; Chapman & Hall, London. $4.

In revising this well known text the authors have added a chapter on hydraulic similitude and dimensional analysis in recognition of growing interest in the study of many hydraulic problems by means of models. They state also that new material has been added on the variation of hydrostatic pressure with altitude in a compressible fluid, on flow through gates and over dams, on the general consideration of the flow of liquids in pipes, on analysis of flow in pipes, and on the resistance offered to motion of an object through a fluid.

About South America

THE RIVER PLATE REPUBLICS—By Betty de Sherbinin. 276 pp. Coward-McCann, Inc., New York. $4.

This is not an engineering textbook, but for an engineer who contemplates going to Argentina, Uruguay or Paraguay, it would be a valuable book for him to read and take with him. For anyone who has traveled in those countries it is delightful as it brings back memories—in my case, most of them pleasant.

Of course, most of the book is devoted to Argentina, which is as it should be because that country is far larger, richer and more populous. Miss deSherbinin lived in the Argentine for many years while she was growing up and has made many trips back to these three neighbor countries since then, the most recent in 1947. She tells not only of the geography of these three countries but of their people, industries and way of life, not only of the big, important cities but of the smaller communities. For that reason, her account will be useful to engineers or contractors who plan to go to any one of the three countries to work. She takes her readers a thousand miles up the river Plate tributary, the Parana River, through Paraguay's almost impenetrable Chaco and along the Uruguayan resort coast, from magnificent Montevideo to the Brazilian boundary.—*Reviewed by* FARLEY GANNETT, *Consulting Engineer, Harrisburg, Pa.*

Miscellaneous Notes on Booklets and Reprints

A STUDY OF CULVERT HYDROLOGY by D. B. Krimgold of the U. S. Soil Conservation Service entitled "On The Hydrology of Culverts" has been reprinted from the 1946 *Proceedings* of the Highway Research Board. While the supply lasts, copies can be obtained free of charge from M. L. Nichols, Soil Conservation Service, Washington, D. C.

A DIRECTORY OF ENGINEERING DATA SOURCES has been published by the Southeastern Research Institute, 5009 Peachtree Road, Atlanta, Ga. ($2.) Included are the names of federal government agencies issuing engineering data and technical publications; publications of universities and state agencies; publications of scientific and trade associations, and commercial publishers of technical books. There is also a classified list of publications.

ENGINEERING INFORMATION concerning wood and wood-base materials for house construction has been assembled in a 330-page handbook, "Manual on Wood Construction for Prefabricated Houses," published by the Housing and Home Finance Agency and the Office of the Housing Expediter. Much of the data can be applied to all types of housing, whether factory or site fabricated. More than 200 photographs and detail drawings illustrating processes, designs, and techniques employed by many of America's leading prefabricators are included in the book. Copies can be obtained from the Superintendent of Documents, Washington 25, D. C., $1.50.

VARIOUS TYPES OF VALVES, sluice gates and control gates developed in Germany during war years are described in a report prepared by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Copies of this 78-p. mimeographed report (PB-81623) can be obtained for $2.25 from that office. Make check payable to Treasurer of the United States.

THE RESEARCH FACILITIES of the Waterways Experiment Station at Vicksburg, Miss., are described in a new pamphlet entitled "Waterways Experiment Station", which can be obtained from the Mississippi River Commission at Vicksburg. Started about 20 years ago chiefly for study of river-control problems by means of models, the laboratory now is by far the largest in the world, with 500 acres in the Vicksburg reservation and 820 at the newer Clinton reservation, where a model of the entire Mississippi system has been built.

New Engineering Books

SUBSTRUCTURE ANALYSIS AND DESIGN—By Paul Andersen. 305 pp. Irwin-Farnham Publishing Co., Chicago, Ill. $4.50.

ELEMENTARY STRUCTURAL ANALYSIS—First Edition—By J. B. Wilbur and C. H. Norris. 523 pp. McGraw-Hill Book Co., New York 18 and London. $6.

VIBRATION AND SOUND—Second Edition—By Philip M. Morse. 468 pp. McGraw-Hill Book Co., New York 18 and London. $5.50.

MODERN PLYWOOD—Second Edition—By Thomas D. Perry. 458 pp. Pitman Publishing Corp., New York and London. $6.

CONCRETE WATERPROOFING—By L. E. Hunter. 128 pp. Sir Isaac Pitman & Sons, London, Pitman Publishing Corp., New York. $2.50.

SIMPLIFIED ROOF FRAMING—Second Edition—By J. D. Wilson and S. O. Werner. 160 pp. McGraw-Hill Book Co., New York and London. $1.80.

(*Continued on page* 142)

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Rock Drilling
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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

June Materials and Labor Prices will appear in the June 10, 1948 issue

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		READY-MIXED CONCRETE 1:2:4, over
	Cloth	Paper	Bulk	1½ in.	¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt. Agg.	5.0 sack mix, del
Atlanta	$4.03	$3.26	$2.98	$2.00	$2.00	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	$0.1725	$11.00
Baltimore	3.91	3.14	2.86	2.20*ff*	2.20*ff*	1.80*ff*	2.40*ff*	....	2.35*ff*	2.35*ff*	.15	.15*w*	9.20
Birmingham	3.65	2.88	2.55	2.06	2.06	1.66	2.50	2.50	1.00	1.20	.15	.15	7.45
Boston	4.39	3.62	3.34	1.50‡*t*	1.50‡*t*	1.40‡*t*	1.25‡*t*	1.35‡*t*	....	....	.186	.195*w*	10.50*m*
Chicago	3.65	2.88	2.60	2.75‡*d*	2.75‡*d*	3.20‡*d*	2.75‡*d*	2.75‡*d*	2.00‡	2.00‡	.20	.20*x*	....
Cincinnati	3.87	3.10	2.82	1.85‡*pp*	1.85‡*pp*	1.75‡*pp*	2.95‡*bb*	2.95‡*bb*	2.20	2.20	.19	.195	9.85*hh*
Cleveland	3.82	3.05	2.72	1.90*llq*	1.65*llq*	1.45*ll*	3.45‡*h*	3.45‡*h*	2.60	2.60	....	.21	11.20*ss*
Dallas	3.57	2.80	2.52	2.00	2.15	1.75	2.00	2.10	....	....	.0775*p*	.255	8.85
Denver	....	3.32	3.02	1.85	2.00	1.15	....	....	....	....	.20	.2175*w*	9.65
Detroit	3.67	2.90	2.62	3.00‡	3.00‡	2.75‡	2.75‡	2.75‡	2.75‡	2.75‡	.17	.18*w*	9.15*kk*
Kansas City	3.68	2.88	2.63	2.05	2.05	1.40/1.60*t*	1.45*q*	1.45*q*	....	....	.16*uf*	.175*ay*	9.80*n*
Los Angeles	....	3.60*b*	3.20*b*	1.92*t*	2.02*t*	1.72*tnn*	1.92*t*	1.92*t*	....	....	.085*oo*	....	9.90*m*
Minneapolis	3.91*dd*	3.14*dd*	2.86*dd*	2.10h‡*j*	2.10h‡*j*	1.20h‡*j*	2.20h‡*j*	2.20h‡*j*	....	....	.19*cco*	....	9.65/9.85*r*
Montreal	....	2.29*r*	2.14*r*	1.75*bbs*	1.75*bbs*	....	1.55*cs*	1.75*cs*	....	....	.1936	.2265*w*	7.75*k*
New Orleans	3.63	2.86	2.58	2.13	2.13	1.82	....	....	.90	1.15	.23	....	10.65
New York	....	4.00‡	....	2.00*de*	2.00*de*	1.45*de*	2.00*ds*	2.00*ds*	....	....	.18*ii*	.18*ccii*	10.50*k*
Philadelphia	3.71‡	2.94‡	2.66‡	2.30‡	2.40‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.22/.25	.22/.25*w*	9.85
Pittsburgh	3.78	3.01	2.73	2.05‡	2.05‡	2.35‡	2.50‡	2.50‡	2.05	2.05	.22*z*	.22*z*	10.85
St. Louis	3.76*o*	2.99*o*	2.71*o*	2.35‡*oh*	2.35‡*oh*	2.00/2.35‡*oh*	1.50*c*	1.50*c*	1.10	1.15	.20	.22*yo*	10.40
San Francisco	.....	3.38	2.98	1.84	1.84	1.94	1.94	....	....	....	....	.25*y*	10.75*k*
Seattle	.....	3.45*mm*	2.95*mm*	2.75‡*od*	2.75‡*od*	2.75‡*od*	3.50‡*od*	3.50‡*od*	....	....	.22*o*	....	9.75*p*

‡ Delivered. *a* F.o.b. truck at plant. *b* 10c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks, Man. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* ¼ in. *j* 5% discount for cash. *k* 5 cu. yds. or over, del. Man. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. truck at plant. *r* 10c per bbl. off cash 20 days. *s* Sales tax included. *t* Truck delivery. *u* 10 to 100 c.y., brackets. *v* F.o.b. scow, Hudson River, N. Y. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Aver. haul, 7-9 mi., zone. *bb* Under 5 tons. *cc* 8 x 8 x 18 in., also. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bag. *ff* LCL. *gg* 10c. refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *ll* Price at plant, called for. *mm* 10¢ per bbl. off cash 10 days. *nn* Concrete sand. *oo* 4x8x12 std. wgt. *pp* 5 tons or more. *Prices include dealer's commission except where indicated to the contrary. †Not including 40¢ heating charge included in price from Nov. 1 to Apr. 15.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.05 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 28c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.10	$2.10	Ironton, Ohio	$2.15*	$2.15*	Universal, Pa.	$2.21	$2.26
Hannibal, Mo.	2.21	2.20	Northampton, Pa.	2.15	2.15	Waco, Tex. (Plus 9c. tax in Tex.)	1.95	1.95
Independence, Kans.	2.20	2.20	Richard City, Tenn.	2.20	2.20	Montreal City (Discount 10c. per bbl. 20 days)	1.98	1.98
* Destination price base effective Dec. 22, 1947			Steelton, Minn.	2.30	2.30			

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80-300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums		Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	.....	$0.074	.....	$0.0806*h*	.....	$0.0781	$0.0806	.....
Baltimore	150.00‡	52.70‡	.....	15.00	$21.00	0925	$0.1225	15.00	$25.00	.095*x*	.095	$0.115
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	85.00	59.00	3.75	17.00*o*	29.50*o*	0723*o*	1447*o*	075*ho*	.15*ho*	.07*o*	.0907*o*	.18*o*
Chicago	150.00‡*y*	80.00*e*‡	2.97/4.10*d*‡	22.50*b*	32.00*b*	21.50*bg*	31.00*bg*	.097/.10*bh*	.....	.082/.0845*b*	.0925/.1025*b*	.14/.165*b*
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	186.52	52.00*t*	3.84*u*	28.00	38.00	27.00*g*	37.00*g*	.13*h*	.21*h*	.125	.20	.27
Dallas	*l*	40.00	*l*	23.38	42.17	.0987	.1837	26.15	46.65	.0962	.1037	.....
Denver	.....	40.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	63.00*x*	.....	27.00	26.00	18.40*g*	24.40*g*	.0811*h*	.128*h*	.075	.1085	.1522
Kansas City	.....	40.00*q*	.....	20.45*r*	.....	.....	.....	081*hr*	.....	.071*r*	.....	.....
Los Angeles	....	.....	*l*	16.00*mf*	32.75*mf*	16.00*m*	32.75*m*	16.50*m*	33.25*m*	15.50*m*	.0675*cc*	.1375*cc*
Minneapolis	.....	.....	2.79*d*	28.00	37.00	23.00*g*	34.00*g*	27.00	38.00	105	.13	.23
Montreal	125.00	.....	.....	21.60*k*	31.25*k*	14.10*kp*	18.35*kp*	14.00*kp*	16.00*kp*	12.50*kj*	.153*k*	.194*k*
New Orleans	.....	.....	.....	20.00*a*	..... *s*	20.00*qa*	..... *s*	9.50*a*	..... *s*	.095	.0975	.16*a*
New York	.....	.....	2.50*d*	25.95	36.35	24.95*g*	42.79*g*	.1068*h*	.1832*h*	.1018	.1066	.1889
Philadelphia	150.00	62.00	4.06	23.00	.....	22.00*g*	.....	.095*h*	.....	.....	.....	.....
Pittsburgh	165.00	42.00	4.10	26.00	39.00	.12	.24	27.00	42.00	.0925	.10	.21
St. Louis	.....	48.50	.....	16.50/17.50	22.50/23.00	15.50/16.00*g*	21.50/22.00*g*	.075/.08*h*	.165/.17*h*	.065/.07	.075/.095	.125/.155
San Francisco	.....	57.75*c*	.....	16.50	33.75*w*	16.50*g*	.....	17.50	.....	.....	.0725	.1425
Seattle	.....	.....	.....	16.50*i*	33.00*i*	15.00*ig*	.....	18.00*i*	22.00*aai*	16.00*i*,	.0675*i*	.0825

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. refinery. *c* 2¼ x 8¼ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* 40-80 penetration. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums, per drum. *k* Tax included. *l* Not used. *m* F.o.b. refinery, El Segundo. *n* 55 gal. drums. *o* Price at plant, in Everett. *p* Per 100 gal. *q* F.o.b. Buffalo. *r* F.o.b. Sugar Creek, Mo. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *u* 3-in. *v* Bulk, refinery. *w* Shipped in double-head wood barrels. *x* Truck deliveries in Detroit $75.00. *y* Carload lots. *aa* In customer's drums. *cc* F.o.b. refinery, Inglewood.

IRON AND STEEL PRODUCTS — BASE MILL PRICES

	STRUCT. SHAPES—PLATE/	REINF. BARS* billet bef	RIVETS* ½-in. structural f	WIRE NAILS* Base df	SHEET PILING* Base/	STEEL RAILS* Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES/* Angle Bars	Std Spikes c	Tie Plates c	Track Bolts
Birmingham	$2.75	$2.75	$5.65	....	....	$55.00	$62.00	Not	$3.85	$4.85	$3.65	$7.00
Chicago	2.75	2.75	5.65	....	$3.30	.....	.....	avail-	3.85	4.85	3.65	7.00
Pittsburgh	2.75	2.75	5.65	...	3.30	55.00	62.00	able	3.85	4.85	3.65	7.00
Buffalo	2.75	2.75	....	....	3.30	.....	.....	....	....	....	3.65	....
Cleveland	....	2.75	5.65	....	....	.....	.....	....	....	....	....	....
Youngstown	....	2.75	....	....	....	.....	.....	....	....	4.85	....	....
Gulf ports	....	....	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.975‡*	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.41/3.47‡*	3.329‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *b* Rail steel price upon application. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports. On tie plates alone, Steelton, Pa.; on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per CL. *e* Mill lengths. Add 50¢ for cut lengths. *f* Per 100 lbs.
* May decrease not reflected in these prices.

IRON AND STEEL PRODUCTS — F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

May decrease not reflected in these prices	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS*g* Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH*k* Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires	SHEET PILING Per 100 lb. base price.
Atlanta	$5.12‡	$5.12‡	$5.12‡	$.025	$.10	$31.00	$33.00	$2.58	$1.78	$2.71	....
Baltimore	4.71	3.97*t*	....	....	.10	33.50	35.50	2.41	1.67	2.53	....
Birmingham	4.25	4.40	4.40	.05	.15	40.00*p*	43.00*p*	2.56	1.76	2.68	....
Boston	4.97‡	4.72‡	4.19‡*c*	....	.10/.15	29.00	31.00	2.49	1.72	2.62	$3.8032*k*
Chicago	4.40	3.50*ff*	3.50*ff*	.05	.05	27.00‡	29.00‡	2.26	1.58	2.37	3.30*n*
Cincinnati	4.82‡	3.883*e*	3.883*e*	....	....	29.00*zee*	31.00*zee*	2.40	1.66	2.52	3.708*d*
Cleveland	4.70	3.39*v*	....	....	.10	29.00	31.00	2.36	1.63	2.47	....
Dallas	6.72	5.00	5.00	....	....	32.50	35.00	2.66	1.83	2.79	....
Denver	5.95	5.80*e*	....	....	....	40.00*s*	45.50*qs*	2.69	1.84	2.82	5.89
Detroit	4.82‡	4.73	....	....	.10	33.50*z*	35.50*q*	2.40	1.66	2.52	3.683*gd*
Kansas City	5.35*ee*	4.23*aak*	4.23*aak*	....	.10	34.00	36.00	2.47	1.71	2.59	3.893*k*
Los Angeles	5.15*f*	5.10	....	....	....	39.00*fk*	45.00*fk*	2.76	1.89	2.90	4.78*d*
Minneapolis	4.83‡	5.179*ccn*	5.179*ccn*	...	.15	30.50*k*	32.50*k*	2.47	1.70	2.58	3.864*k*
Montreal	4.90*i*	4.25*i*	4.25*i*	....	....	40.28*h*	42.98*h*	2.54	1.75	2.66	78.70*jdqq*
New Orleans	....	4.64*ok*	....	.05	.10	27.50	29.50	2.54	1.75	2.67	.....
New York	4.80	4.60	....	....	.15/.20	30.00*st*	32.00*st*	2.46	1.69	2.58	3.35*a*
Philadelphia	4.57	4.59	....	....	....	30.00‡	32.00‡	2.42	1.68	2.54	3.77
Pittsburgh	4.40	4.40	4.40	.05	.10	32.50	34.50	2.26	1.58	2.37	5.05
St. Louis	4.73‡	4.458*c*	4.458*c*	....	.05	40.00‡	42.00‡	2.38	1.65	2.49	....
San Francisco	5.20	4.53	....	....	....	32.50	34.50	2.76	1.89	2.90	4.85
Seattle	3.628*e*	4.43*el*	....	....	....	35.00*ic*	38.50*ic*	2.76	1.89	2.90	4.355*dd*

‡ Delivered. *a* Mill prices. *b* 1-5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plant *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c, differences between new billet and rail steel. *h* List price. Dominion tax exempt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate and hard grade, new billet. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed. 4 lb. per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10c, ¾ in., ⅞ in. 15c, ½ in. 20c, ⅝ in. 35c, ¾ in. 55c, ⅞ in. $1.30. *v* Under 20 tons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *cc* F.o.b. cars Chic. plus freight. *dd* F.o.b. dock. *ee* F.o.b. cars. *ff* Carload lots. *gg* Including sales tax.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13-44T std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4-24 per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered: ASTMC 14-41 12 in.	24 in.	WROUGHT STEEL PIPE** (Full standard weight, f.o.b. destination *x*) 2½ & 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$85.84	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	47.2	31.2	42.2	25.7
Baltimore	90.02	.378	.729	3.105	8.098	147.00	228.00	.80	2.20	50.9	34.9	45.9	29.4
Birmingham	79.50	.375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	47.2	31.2	42.2	25.7
Boston	93.14	392*uvx*	.756*uvx*	3.465*uvy*	9.3025*uvy*	150.60	233.40	1.03*jcc*	2.75*jcc*	49.2	33.2	44.2	27.7
Chicago	92.17	.54	1.04	4.12	12.80	150.00‡	270.00‡	.65	2.25	53.0*t*	37.0*t*	47.0*t*	30.5
Cincinnati	90.73	.441*	.8505*	3.51*	9.53*	154.80‡*	241.20‡*	.60	2.25*	51.4	35.4	46.4	29.9*t*
Cleveland	92.74	.35*x*	.675*x*	2.97*x*	9.3025*x*	141.50	221.00	.58	2.25	53.7	37.7	48.7	32.2
Dallas	94.48	.375	.675	2.70	6.20	109.00	131.00	.45	1.45	45.3	29.3	40.3	23.8
Denver	99.32	.40*dd*	.71*dd*	2.98*dd*	....	.....	.....	.74*dd*	2.50*dd*	43.4	27.4	38.2	21.7
Detroit	92.74	.63	1.215	4.815	11.21	195.00‡*m*	303.00‡*m*	.55	2.20	51.9	35.9	46.9	30.4
Kansas City	93.82	.39*m*	.705*m*	2.78*m*	7.15*m*	180.00*m*	310.00*m*	.69*l*	1.90*l*	48.7	32.7	43.3	26.8
Los Angeles	105.70	.414	.894	4.347	10.868	220.00‡	360.00‡	.65	....	....	....	....	....
Minneapolis	96.00	.55*mo*	1.05*mo*	4.10*mo*	....	.....	.....	1.19*h*	3.18*h*	48.8	32.8	43.4	26.9
Montreal	78.20	.73*i*	1.28*i*	4.20*i*	6.80*ei*	.60*paa*	.48*paa*	72.00*jkaa*	218.00*jkhaa*	....	....	....	....
New Orleans	88.72	.412	.762	3.955	9.15	231.00*bb*	.....	.55	1.95	46.8	30.8	41.8	25.3
New York	89.06	.62	1.14	4.45	12.30	.....	.....	1.00	2.25	50.2	34.2	45.2	28.7
Philadelphia	87.14	.50	.95	3.95	9.75	220.00‡	275.00‡	1.05*h*	2.75*h*	50.7	34.7	45.7	29.2
Pittsburgh	93.22	.364*m*	.702*m*	2.70*m*	6.625*m*	130.20	197.40	1.05*h*	2.50*g*	54.0*t*	37.0*t*	49.0*t*	32.5*t*
St. Louis	90.16	.40	.72	2.88	6.53	.....	.....	1.10*il*	2.30*hl*	50.6	34.6	44.7	28.2
San Francisco	105.70	.438*d*	.878*d*	3.69*d*	9.23*d*	169.00*dl*	282.00*dl*	.69	2.85	....	....	....	....
Seattle	107.50	.45*b*	.81*b*	....	....	72.50*e*	.....	.80	2.40	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, CL, Burlington, N. J. (base) $84.50. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional. 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM C 200-44T. *c* 4-in. *d* SS361-A. *e* 30 in. *g* Culvert pipe. Reinforced, ASTM C76-41. *h* Reinforced. ASTM C75-41. *i* Reinforced. ASTM C76-37. *j* Centrispun. *k* Per 100 ft. *l* F.o.b. plant. *m* Truck delivery. *o* Listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per ft. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13-40. *v* F.o.b. city *x* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A60-1941 specifications used. *aa* No. standard specifications in Can. *bb* Freight allowed to destinations in city. *cc* Truck loads; f.o.b. plant, Newton. *dd* LCL, delivered, f.o.b. truck. **20% emergency freight rate increment granted railroads on Jan. 5 and May 6 freight rate increase (10% in East; 5% on average for U. S.) not included. *Correction: May prices have been in effect since Jan. 1948.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld — 1 in. and 1¼ in. black, 34 galv. 16; 1¼ in. black, 38 galv., 18½; 2 in. black, 37½, galv., 18. Lap weld — 2½ in to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

		SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)								LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for basic price)
		All Fir planks No. 2 common. Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)										
		1x6 s4s	1x8 s4s	2x4 s4s	2x6 s4s	2x8 s4s	2x10 s4s	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	5/8"
Atlanta	*l*	**$80 00**	**$82 00**	**$70 00**	**$70 00**	**$75 00**	**$76 00**	**$80.00**	.....	.....	.....	.....	$22.32
	l	*95 00*	*95 00*	*96 50*	*96 50*	*96 50*	*96 50*	*87 50*	*$87.50*	*$87.50*	.....	.....	.....
Baltimore		**96 00**	**96 00**	**96 00**	**95 00**	**100 00**	**104 00**	**115 00**	.....	.....	193.60	182.00	22.86
		106 00	*108 00*	*112 80*	*112 00*	*114 00*	*114 00*	*121 00*	*121.00*	*121.00*	.....	.....	.....
Birmingham	*l*	**90 50**	**90 50**	**87 00**	**86 00**	**87 00**	**90 00**	**110 00**	.....	.....	120.00	117.50	21.78
	l	*95 50*	*95 50*	*92 00*	*91 00*	*92 00*	*95 00*	*114 00*	*102 00*	*105 00*	.....	...	.....
Boston		88 00[3]	90 00[3]	88 00[3]	88 00[3]	90 00[3]	93 00[3]	100 00[3]	.....	.....	.....	.....	22 86
		95 00	*95 00*	*95 00*	*95 00*	*95 00*	*95 00*	*105 00*	*105 00*	*105 00*	105.00	105.00	.....
Chicago	‡	**100 00**	**104 00**	**93 00**	**93 00**	**93 00**	**100 00**	**100 00**	.....	.....	125.00	125.00	18.72
	‡	*108 00*	*108 00*	*100 00*	*100 00*	*100 00*	*105 00*	*105 00*	*105.00*	*105.00*	.....	.....	.....
Cincinnati		**100 00**	**100 00**	**95 00**	**95 00**	**95 00**	**95.00**	**130 00**	....	.....	120.00	.....	21.78
Cleveland		**92 95**	**92 95**	**82 89**	**82 89**	**82 89**	**87 94**	.....	.....	.....	.....	.....	22 20
Dallas	*l*	**71 00**	**71 00**	**61 00**	**59 00**	**61 00**	**66 00**	**80 00**	.....	.....	72.00	80.00	18.72
Denver		*101 00*	*100 00*	*97 00*	*94 50*	*94 00*	*95.50*	*97 00*	*104.50*	*103.50*	.....	.....	13 92
Detroit		**98 00**	**98 00**	**90 00**	**90 00**	**95 00**	**93 00**	**93 00**	.....	.....	90.00	103.00	21.78
		98 00	*98 00*	*92 00*	*92 00*	*98 00*	*95 00*	*100 00*	*100.00*	*105.00*	.....	.....	.....
Kansas City	*b*	**105 00**	**110 00**	**100 00**	**100 00**	**100 00**	**105 00**	.....	.....	.....	.....	.....	16.56
	b	*105 00*	*110 00*	*100 00*	*100 00*	*100 00*	*105 00*	*110 00*	*125 00*	*125 00*	.....	.. ..	.....
Los Angeles	*a*	*108 00*	*108 00*	*108 00*	*108 00*	*108 00*	*108 00*	*107 00*	*117 00*	*107 00*	.....	.....	13 38*gh*
Minneapolis	‡*b*	112 00[3]	112 00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	16.56
	‡*b*	*108 00*	*108 00*	*108 00*	*108 00*	*108 00*	*110 00*	*130 00*	*130 00*	*130 00*	.....	....	.....
Montreal	*e*[4]	73 00	76 00	70 00	72 00	76 00	85.00	.....	.....	.....	.....	.....	.....
		111 55	*111 55*	*111 55*	*111 55*	*111 55*	*111 55*	*120 00*	*87 00*	.....	.....	.....	.....
New Orleans	*l*	**80 00**	**90 00**	**75 00**	**80 00**	**80 00**	**77 00**	**85 00**	.....	.....	100.00	105.00	18.72
	l	*68 00*	*68 00*	*70 00*	*67 00*	*67 00*	*67.00*	*71 00*	*67.00*	*72.00*	.....	.....	.....
New York	‡	**100 105**	**100 105**	**Range from $90 00 to $95 00**				**110 115**	.....	.....	175/200†	175/200†	22 86
	‡			*Rate e from $105.00 to $110.00*				*115 120*	*115 120*	*115 120*	.....	.....	.....
Philadelphia				**Range from $100.00 to $110.00**				**100 110**	.....	.....	150.00	150.00	22.86
				Rate e from $110.00 to $120.00				*110 120*	*110 120*	*110 120*	.....	.....	.....
Pittsburgh	*l*	**75 00**	**77 00**	**80 10**	**80 10**	**85 25**	**89 70**	**107 75**	.....	.....	130.20	141.00	22.56
	l	*93 60*	*93 60*	*88 00*	*88 00*	*87 00*	*91 00*	*110 00*	*116 00*	*118 00*	.....	.....	.....
St. Louis	‡*j*	**110.00**	**110 00**	**110 00**	**107 00**	**110 00**	**113 00**	.....	.....	.....	.....	.....	18.72
	‡*j*	*110 00*	*110 00*	*117 00*	*119 00*	*119 00*	*120 00*	*130 00*	*130 00*	*130 00*	.....	.....	.....
San Francisco	*d*	*76 50*	*76 50*	*76 50*	*76 50*	*76 50*	*74 50*	*74 00*	*74 00*	*74 00*	.....	.....	10.08*g*
Seattle	*l*	*70 00h*	*70 00h*	*70 00h*	*70 00h*	*70 00h*	*70 00h*	*75 00h*	*75 00h*	*75 00h*	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [3] Spruce. [4] Western Pine. No. 3 Common. [1] Norway Pine. ‡Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Direct mill prices; f.o.b. purchasers carrier or truck. *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are retail yard prices quoted per truck load in Greater Cleveland. Less 2% for cash. Truck lots. *l* F.o.b. mill.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼", $174.00; on ½", $200.00. For other centers add rail freight increment from table on proper size. For oiling add $3.00; for edge sealing add $2.00; for resin sealing add $8.50.

* Freight rates include 20% emergency increase granted railroads on Jan. 5.

† 18 ft. and under.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946. Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*
	A quality	B quality	
Atlanta	76%	76%	$0.195
Baltimore	70–10%	71–10%	.195
Birmingham	68%	68%	.15
Boston	77%	78%	.195
Chicago	68%*e*	68%*e*	.195
Cincinnati	67–6%*g*	67–6%*g*	.195
Cleveland	67–10–10%	67–10–10–10%	.235
Dallas	67%*e*	68%*e*	.2075
Denver	68%	68%	.20
Detroit	67–10–10%	67–10–10%	.195
Kansas City	68-10%*g*	68-10%*g*	.20
Los Angeles	62%	67 %*h*	.2025
Minneapolis	68%	68%	.20
Montreal	40–5%*ab*	40–10–5%*ab*	18.25*i*
New Orleans	68%	68%	.205
New York	73%	74%	.265*f*
Philadelphia	69%	70%	.195
Pittsburgh	70–10%	70–10%	.1675
St. Louis	70–10%	70–10%	.20
San Francisco	66%	73%	.20
Seattle	57%	58%	.2025

Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%

a Discount from list, Sept., 1939; all now tax exempt. *b* Single thickness. *e* Discount from list of Jan. 29, 1947. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $9.00 per trip. *g* Discount from list of Aug 15, 1938. *h* Single thickness. Double thickness, 66⅔. *i* F.o.b. city per 100 lb. forcite, 40%; 60%, $20.00.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.155 – 1625	.18 – .1925	.20 – .2125
Rocky Mtn. States	.155 – 1675	.18 – .1975	.20 – .2175
Pacific N. W. States	.1525–.165	.1825–.195	.2025–.215
Pacific S. W. States	.15 – .1575	.18 – .1875	.20 – 21

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	By Rail — Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in.—2-ft. from butt	6-in	50 to 59-ft.	.35	....
12-in.—2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.—2-ft. from butt	6-in.	90 to 100-ft.	....	62
13-in.—3-ft. from butt	5-in.	91 to 100-ft.	....	.63
14-in.—2-ft. from butt	6-in.	50 to 69-ft.	.41	.70
14-in.—2-ft. from butt	6-in.	70 to 79-ft.	.43	.64
14-in.—2-ft. from butt	5-in	80 to 85-ft.	.54	65
14-in.—2-ft. from butt	5-in.	85 to 89-ft.	.57	.66
14-in.—2-ft. from butt	5-in.	90 to 100-ft.	....	.70

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.45	.....	$2.00	.....
	Pine	1.35	$3.05*a*	1.90	$4.00*a*
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.40/2.50*a*	....	3.25/3.40*a*
Los Angeles	Douglas Fir	1.86	2.82*a*	....	....
Philadelphia	Red Oak	2.33	3.13*a*	3.10	4.25*a*
St. Louis	White Oak	1.75	....	2.45	.....
	Red Oak	1.70	2.35*a*	2.40	3.40*a*
	Sap Pine or Cypress	2.20*a*	....	....	.....
San Francisco	Douglas Fir	1.60*ef*	2.80*f*	2.10*bf*	3.88*eaf*
Montreal	Birch or Maple	....*h*	....*h*	....*h*	....*h*

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *c* Empty cell. *e* Green. *f* F.o.b. cars. *h* No constant price available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$3.75
Chlorine cylinders, liquid, per lb. f.o.b. works	.07–.12
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, f.o.b. works, ton	22.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.65
Soda ash, 58%, in paper bags, per 100 lb. dense	1.38
Sulphate of aluminum, commercial, in 100-lb. bags f.o.b. works	1.15–1.30
Sulphate of copper, in bags, per 100 lb f.o.b. works	7.60

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over.			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over.			BRICK Per M. in quantity		LIME Per ton. In paper. Carload lot.		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverized, or lump
Atlanta	.....	.....	.....	.....	.....	.....	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	$120.00	$126.00	$220.00	$240.00	$315.00	$340.00	31.00*k*	33.00*k*	30.00	18.00	.....
Birmingham	97.50	104.00	195.00	231.00	.....	.....	20.00*ff*	22.50*gg*	24.67	18.10	.....
Boston	105.00†	112.00†	210.00†	252.09†	.....	.....	20.00*i*	20.00*i*	21.00†	.....	16.00
Chicago	115.00	122.50	230.00	.....	.....	.....	20.00	21.00	25.00	18.00	.....
Cincinnati	155.00*j*	165.00*j*	220.00*jdd*	.....	.....	.....	33.00*j*	33.00*j*	22.00*j*	20.25*j*	.....
Cleveland	113.50*cc*	121.00*cc*	222.50*cc*	.....	.....	.....	27.50	27.50	21.45	19.45	23.55*ee*
Dallas	.....	106.00	.....	.....	.....	.....	18.00	20.00	28.00	22.00	.....
Denver	.....	.....	.....	.....	.....	.....	28.50	28.50	34.80*hh*	28.00*hh*	34.00*hh*
Detroit	130.00	145.00	260.00	300.00	380.00	443.00	28.00*cc*	30.50*cc*	28.00	26.50	26.00
Kansas City	112.00	120.00	.....	.....	.....	.....	16.00*o*	18.50*o*	36.00*p*	30.00*p*	30.00*p*
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	20.00§	.....	33.20	33.20	27.00
Minneapolis	162.10*p*	187.00*p*	334.30*p*	187.00*wp*	.....	.....	27.00*rp*	.....	33.50*bb*e	24.50*bb*e	33.50*bb*de
Montreal	100.00*aq*	110.00*aq*	206.25*aq*	151.50*aqq*	.....	294.40*aq*	24.00	34.50	12.50*uh*	14.00*uh*	18.45*u*
New Orleans	160.00	160.00	300.00	.....•	.....	.....	29.00	.....	30.00	20.00	.....
New York	112.20	119.60	164.50	179.40*hn*	.....	.....	29.00	.....	34.00	25.90	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	26.00	29.00	29.75	17.50	24.50
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	26.00	31.00*y*	20.45	18.65	2.97*m*
St. Louis	118.50	122.00	225.00	235.00	305.00	.....	28.50*nl*	26.50*nl*	.72*saap*	.55*saap*	.82*saapee*
San Francisco	124.00*a*	139.50*a*	186.00*dda*	139.50*ta*	.....	.....	27.50	.....	24.85	24.85	2.48*m*
Seattle	137.00*cc*	147.00*cc*	.....	147.00*ccw*	.....	.....	28.50	33.50	32.00*ahh*	32.00*ahh*	3.60*mhh*

† F.o.b. *a* Smooth. *b* Per 50 lb. bags. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *g* 5½ x 8 x 12. *h* F.o.b. trucks, job site N.Y.C. *i* F.o.b. warehouse only. *j* Truck load or over. *k* $1.00 discount. *l* Red face. *m* Per bbl., 180 lb. *n* 7½ x 7½ x 12. Speed title. *o* F.o.b. Buffalo. *p* Truck lots. *q* Provincial and Municipal tax extra. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* Tax exempt. *w* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime not sold per ton. *bb* LCL. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* 80% common. *gg* Select. *hh* LCL. § F.o.b. plant.

PAINT, ROOFING — F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl.	WHITE LEAD Per 100 lb. in 100 lb. cases	READY-MIXED PAINT Per gal., drums			ROOFING SUPPLIES Carload lots f.o.b. factory				
	Dry *a*	In oil *w*	Graphite *b*	Aluminum *c*	Ferric Oxide *d*	Rolls, slate surfaced, 85-90 lb per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl per ton
Atlanta	$21.60	$29.875	$1.75	$2.70	$1.65	$2.06‡	$2.06‡	$2.06‡	$1.00‡	$36.00‡
Baltimore	21.35	29.50	2.25	3.50	2.75	2.75	3.30	3.30	.55	33.00
Birmingham	21.60	29.875	4.40	4.52	....	3.05	3.00	3.00	.48	42.00*ee*
Boston	21.35	29.50	1.75	2.50	2.31	2.00‡*h*	3.30‡*q*	3.30‡*q*	.25‡	21.00
Chicago	21.35	29.50	....	....	....	2.78‡*u*	2.91‡*o*	2.91‡*o*	34.00‡*bb*e	35.00‡
Cincinnati	21.35	29.50	....	....	....	2.30‡	2.50‡	2.50‡	.35*y*‡	40.00‡
Cleveland	21.35	29.50	3.00	3.00*s*	3.00	2.39	2.50*o*	2.50*o*	.32*y*	35.40
Dallas	21.35	29.50	....	4.05	....	2.69*q*	3.00*q*	3.15*q*	.90	45.00
Denver	21.35	30.00	2.88	4.38	2.63	3.17*o*	3.10*o*	.....	.46*yy*	44.00
Detroit	21.35	29.50	2.40	3.20	2.20	2.39	2.50	2.55	.50	33.00
Kansas City	21.35	29.625	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.50	.54	31.00
Los Angeles	21.60	30.00	2.80	4.00	3.50	2.32	1.77*e*	*l*	.65	*l*
Minneapolis	21.35	29.125*m*	....	....	....	2.27*idd*	2.38*hidd*	2.38*hidd*	.42*idd*	33.00*idd*
Montreal	.....	19.20	2.90*p*	4.20*p*	3.62*p*	3.14*t*	2.85*tf*	2.30*tf*	.68*t*	2.15*kt*
New York	21.35	29.50	3.45*y*	....	3.45*y*	2.28	2.3*so*	2.38*o*	.34*s*	33.00
Philadelphia	21.35	29.50	3.25	3.65	*o*.15	2.54	2.94	2.94	.37	26.00
Pittsburgh	21.35	29.50	2.00	2.90	1.90	2.93	3.00*o*	3.00*o*	.37	38.00
St. Louis	21.35	29.50	....	....	....	2.90	2.90	2.90	.44	34.00
San Francisco	21.60	29.75	1.80	2.75*n*	1.35	2.27*x*	3.30*aa*	....	.38*y*	.....
Seattle	21.60	30.00	2.95*m*	2.95*m*	....	3.25*mqcc*	3.35*hmcc*	....	.49*mcc*	46.75*mcc*

‡ Delivered Note: Red lead in oil 50¢ higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb. *f* Per 432 sq. ft. *g* 50 gal. drums. *h* Per roll. 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* May, 1941 price. *o* Per 60-lb. roll. *p* Tax included. *q* Per 90-lb. roll. *r* F.o.b. factory Chicago. *s* ASTM Spec. D266-41. *t* Federal tax included. *u* Per 90 lb. square. *v* Per ton. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums. *aa* Approximate cost per 100 lbs. *bb* Roofers coating and cement. Price per ton. *cc* LCL, truck delivery. *dd* 2% cash discount. *ee* Asphalt in 100 lb. package. *ff* 5-gal. drums.

SKILLED AND COMMON WAGE RATES — PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Electrical Workers	Steamfitters	Common Labor — Building	Common Labor — Heavy Const.
Atlanta	$2.25	$1.65	$2.00	$2.00	$2.00	$2.00	$2.00	$0.75	$0.85
Baltimore	2.50	1.95	2.15	2.20/2.40	2.00	2.00	2.00	1.10	1.10
Birmingham	2.25	1.625	1.90	1.60/1.875	2.00	2.00	2.25	.85	.95
Boston	2.15	2.10	2.15	2.25	2.25	2.15	2.00	1.40	1.40
Chicago	2.20	2.15	2.20	2.15	2.225	2.35	2.35	1.50	1.50
Cincinnati	2.25	1.975	2.10	2.00	2.125	2.125	2.125	1.25	1.15
Cleveland	2.375	2.325	2.375	2.25	2.375	2.125	2.375	1.725	1.40
Dallas	2.25	1.875	2.00	2.00	2.125	2.00	2.125	.95	.95/1.50
Denver	2.25*b*	1.875	2.00*b*	2.00*b*	2.25	2.25	2.24	1.275	1.35
Detroit	2.25	2.025	2.40	2.40	2.25	2.40	2.40	1.875	1.875
Kansas City	2.25	1.90	2.05	1.90/2.125	2.25	2.15	2.125	1.35	1.40
Los Angeles	2.375	1.90	2.10	1.85	2.25	2.25	2.25	1.35	1.35
Minneapolis	2.075	1.80	2.00	1.85	2.25	2.06	2.00	1.30	1.30
New Orleans	2.05	1.70	2.00	1.625/1.875	1.875	2.00	2.05	.90	.90
New York	2.75*b*	2.75*b*	3.00	3.00	3.00*a*	2.50*a*	2.75*b*	1.50	1.70
Philadelphia	2.40/2.50	2.00	2.40	2.25	2.25	2.25	2.25	1.10	1.10
Pittsburgh	2.50	2.25	2.25	2.40	2.25	2.25	2.25	1.30	1.30
St. Louis	2.50	2.20	2.25	2.40	2.25	2.25	2.25	1.35	1.75
San Francisco	2.8125	2.00	2.25	2.00	2.25	2.25	2.25	1.40	1.40
Seattle	2.365	2.065	2.265	2.20	2.365	2.265	2.34	1.665	1.70
Montreal*	1.40	1.06	1.11	1.00	1.17	1.11	1.11	.73	.67

a 6 hr. day. *b* 7 hr. day. *Cost of living bonus now included in basic wage.

MEXICO CITY PRICES

In Pesos, F.o.b. City		Mar. '48	Apr. '48
Common Wages—Building (8 hr. day)	av. per hr.	.57	.57
Common Wages—Heavy Const. (8 hr. day)	av. per hr.	.75	.75
Skilled Labor Wages			
Carpenters (8 hr. day)	av. per hr.	1.25	1.25
Bricklayers (8 hr. day)	av. per hr.	1.25	1.25
Struct. Iron Workers (8 hr. day)	av. per hr.	1.50	1.50
Struct. Steel Shapes 3"-15" x 12 meters	per ton	800.00	800.00
Reinf. Steel, Corr. Rods			
⅜" x 12 meters	per ton	1,000.00	950.00
½" x 12 meters	per ton	975.00	950.00
⅝" x 12 meters	per ton	940.00	940.00
¾" x 12 meters	per ton	940.00	940.00
⅞" x 12 meters	per ton	930.00	930.00
1" x 12 meters	per ton	925.00	925.00
Gravel, truck load of 3½ cu. meters			
Blue Gravel	per tr. load	32.00	30.00
Rose Gravel	per tr. load	28.00	28.00
Cement, Std. Port. (Tolteca)	per ton	115.00	115.00
Lumber			
Mex. Sacred Fir (Oyamel)	per M ft.	400.00	360.00
1st Class Pine	per M ft.	750.00	750.00
2nd Class Pine	per M ft.	550.00	600.00

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $2.180. **ENR Common Average:** $1.315

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

(Number refers to item directly below it)

306

PORTABLE FILLING STATION—Kilroy, this invention of John H. Adler, of Pittsburgh, Pa., although designed to be of greatest service to operators of heavy construction machinery, has additional uses. Its 21-ft. length houses a 700-gal. gasoline and diesel fuel tank system, two batteries of 9 hose reels each, quantities of water, anti-freeze, diesel and gasoline lube oil, air chassis grease, track roll, gear oil, kerosine, and hoist and jack hammer oil. All operations are air-controlled. It can service two pieces of equipment in 15 minutes.—*Jax, Inc., 4925 Friendship Ave., Pittsburgh, Pa.*

307

LOW-BED TILT TRAILER — Tandem axle 8-ton tilt trailer with four wheels and tires is so balanced that one man can raise or lower platform. No jacks or loading ramps are required. Positive automatic safety lock holds platform in position when loaded or empty. Rubber-mounted drawbar absorbs road shocks to protect both truck and trailer.—*C. R. Jahn Co., Chicago, Ill.*

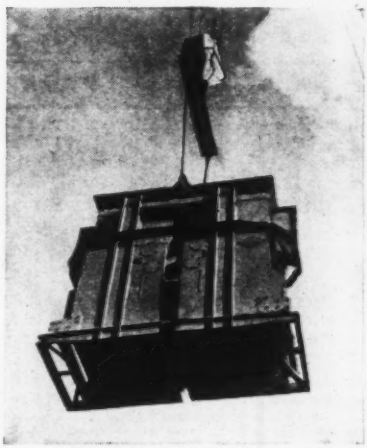
308

AUTOMATIC SPRAY MACHINE—Single-nozzle machine, riding on forms, applies membrane curing material to concrete pavement, is fully automatic in operation and includes remote control start and stop attachment. Double sprays each square foot of concrete. External-mix type spray gun does not foul or drip. Machine equipped with 60 gal. constantly agitated pressure tank is available in widths from 10 to 25 ft. —*Flex-Plane Co., Warren, Ohio.*

309

ROOF FASTENER—For use on asbestos corrugated roofing. "Top-Side" fasteners are claimed to eliminate expense of scaffolding and workmen beneath roof because whole installation is completed from roof surface. Also, the cementing of bolt heads is not necessary because lead covering tabs waterproof each fastener. Only tools required for installation are a drill and speed wrench.—*Keasbey-Mattison Co., Ambler, Pa.*

310



CONCRETE POURING BUCKET—Rectangular bucket has air-operated roller gates and controllable discharge. Larger sizes are dual units formed by coupling together two 4-cu.yd. buckets with combined capacity of 8 cu.yd. Buckets are available in the following sizes: single, 2-4 cu.yd.; dual 6-8 cu.yd. Buckets are rectangular, with vertical sides and controllable discharge. Any portion of bucket load of concrete can be discharged at desired location.—*Blaw-Knox Co., Pittsburgh, Pa.*

311

ALUMINUM ROOFING AND SIDING — Produced as replacement for lumber in residential construction in lengths of 10, 12, 14 and 16 ft. and widths of 6⅞ in. Thickness is 0.030 in.; weight is 580 lb. per 1000 sq. ft. of wall coverage. Can be applied over existing wood sheathing or nailed directly to studs, requiring no sheathing other than standard building paper. Aluminum sections are formed with concave surfaces and lock with a spring action, assuring weather tightness. Both the siding and roofing can be worked by

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EXIDE BATTERIES put power and speed in Diesel Engine Cranking

With Exide Batteries in your Diesel-powered equipment, you can count on dependable cranking performance . . . in all kinds of weather, in all climates. They're built specifically for this tough cranking job . . . extra power for dependable starting . . . extra ruggedness to withstand all hardships.

Day after day . . . and year after year . . . trustworthy Exide Batteries are demonstrating their cranking ability on trucks, buses and off-the-highway equipment . . . on ships and railroad locomotives . . . in power plants and other applications. Wherever they serve, Exide Batteries give convincing proof of their dependability, long life, ease of maintenance and economy.

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BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

Use R B & W Bolts and Nuts . . .

Quick-starting, quick-tightening because they are accurately, uniformly sized and threaded — and carefully inspected.

Vibration-resisting, shock-resisting because the manufacturing method insures extra strength, and all processing is controlled from raw rod to finished product.

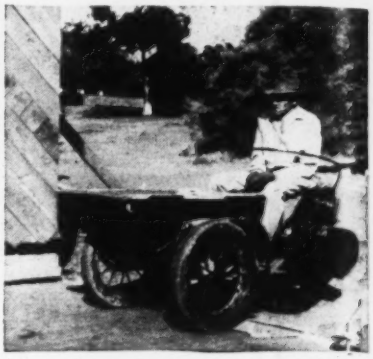
EMPIRE BOLTS NUTS-RIVETS AND ALLIED FASTENING PRODUCTS . . . SINCE 1845

RB&W *Making strong the things that make America strong*

Russell, Burdsall & Ward Bolt and Nut Company. *Factories at* Port Chester, N. Y., Rock Falls, Ill., Coraopolis, Pa., Los Angeles, Calif.; *additional sales offices at* Philadelphia, Chicago, Detroit, Chattanooga, Oakland, Portland, Seattle

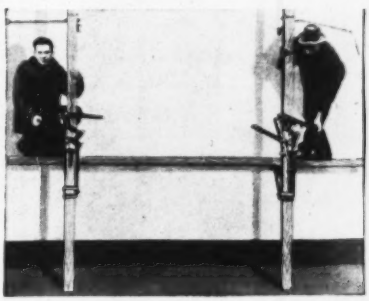
carpenters with regular wood tools. Any house paint can be used on the metal finish. New aluminum line also includes window flashings, door openings and corner trim. Nailing lip on lower edge of siding is pre-punched with elongated holes. — *Permanente Metals Corp., Kaiser Building, 1924 Broadway, Oakland 12, Calif.*

312



MOTORIZED WHEELBARROW — A motorized wheelbarrow, labeled "Power-cart," is capable of carrying 1,500 lb. or 9 cu.ft. of concrete, and will haul all other construction materials. The entire unit weighs 600 lb., and is light enough for scaffolds and runways. The power unit is a 2½-hp. air-cooled gasoline engine, detachable from the cart so that it may be used as a universal small power unit. Of all electric welded construction, the power-cart is anti-friction bearing equipped and has standard parts throughout. It is 81½ in. long and the loading height is 31 in. —*Gar-Bro Manufacturing Co., 2416 E. 16th St., Los Angeles 21, Calif.*

313



PUMP SCAFFOLD BRACKET — Platform rides up or down on any 4x4-in. timber. Scaffold is held to beams by means of pump employing three grips for triple safety. Pump operates and safety locks automatically. Requires no ropes, hooks or nails. Pumps accommodate a 24-in. painter's scaffold and can be adjusted to 12 or 18-in. scaffolds. Designed to eliminate work of transferring men and equipment to each new working level. — *Newark Ladder & Bracket Co., Inc., Walnut and Central Aves., Clark (Rahway), N. J.*

Don't miss this big EQUIPMENT "FAIR"

YOU are due for a big surprise at the 1948 Koehring equipment fair. In one big round-up of excavating, hauling, concrete and materials-handling equipment, you are going to see accumulated postwar changes and cost-cutting improvements in more than 25 modern machines from the complete line of Koehring and subsidiary products. In the exhibit you are going to preview many completely new machines . . . revolutionary developments that will start you figuring for new lower costs and bigger profits.

It's an event you can't afford to miss!

KOEHRING PRODUCT

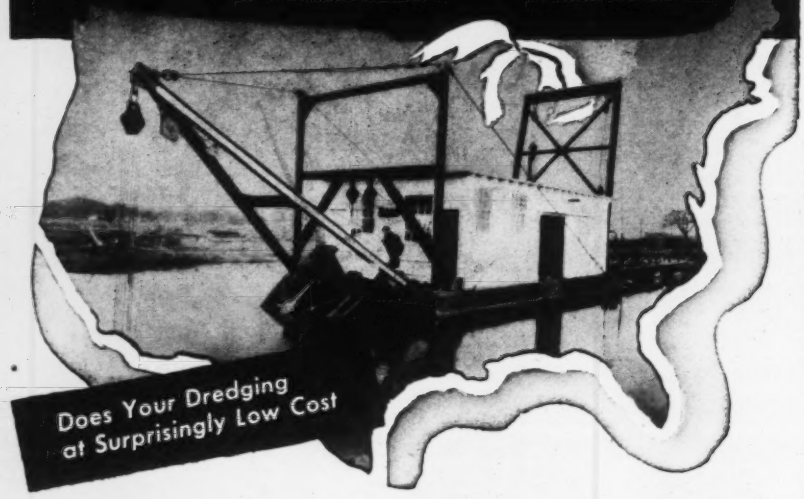
Time: **July 16-24** ***Place:*** **Soldier Field, Chicago** ***Event:*** **1948 Road Show**
Exhibit Booth 3010

JOHNSON • KWIK-MIX

Champaign, Illinois
Koehring Subsidiary

Port Washington, Wisconsin
Koehring Subsidiary

The Morris PORTABLE DREDGE Is EASILY MOVED From Job to Job



Engineers recommend the Morris Portable Dredge because it can be dismantled quickly and moved from one job to another with minimum expense. Does its work rapidly on inland jobs often inaccessible to regular dredging equipment. Operates with only one man, requires only two or three men for manipulating the pipe line.

You Can Use the Morris Portable Dredge on Many Inland Jobs

It cleans water storage reservoirs . . . Deepens lakes and channels . . . Restores eroded beaches . . . Fills in undesirable lowlands . . . Beautifies parks and lakes. It does not disturb solids as much as other dredges . . . nor does it cause excessive turbidity. In fact, in most cases, reservoir water is usable even during the dredging operations.

Order a Morris Portable Dredge Now

We shall be glad to send one of our experienced hydraulic dredge engineers to discuss your dredging problems with you. He will recommend the purchase of a dredge only if its use is sound, practical and economical.

Should you require a dredge, we can design and build it now complete with either electric, gasoline or Diesel engine . . . and make installation of dredge and piping all ready for operation. Furthermore, we shall furnish an operator for an initial period of time until your own dredge operator learns operation and maintenance of the dredge.

Get Full Information About Portable Dredges

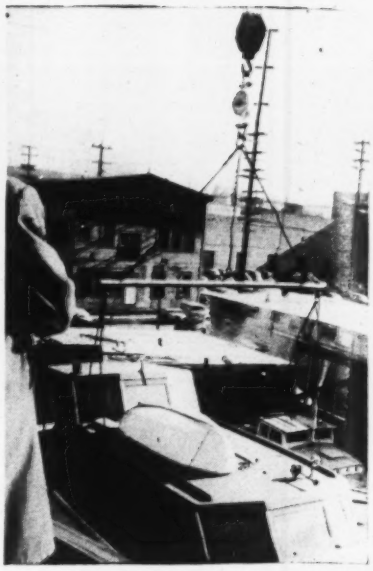
Write us today for Bulletin 177 which illustrates the Portable Dredge and a wide range of other dredges.

MORRIS MACHINE WORKS • Baldwinsville, N. Y.

Sales Offices in Principal Cities

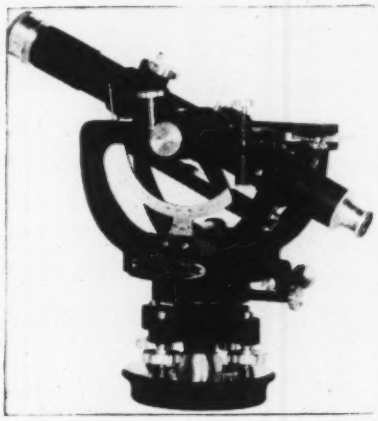
MORRIS *Centrifugal Pumps*

314



TRACTION DYNAMOMETER — A traction dynamometer capable of weighing up to 65½ tons has been developed. Recording is the result of weight on a set of elliptically-shaped steel springs. From a lug welded onto the spring a plunger operates an indicating mechanism consisting of a pulley and cable device which in turn register on an outer dial. Shackles are provided at each end to accommodate a safety bar which takes over when maximum loading is reached. The dynamometer was invented by D. W. Keef, former chief test engineer, Willamette Iron & Steel Corp. It is manufactured to two smaller sizes, one to handle lifts of 15,000 lbs. and the other 15 tons.—*Pacific Engineering Co., Portland, Ore.*

315



TRANSIT LEVEL—Several new improvements have been incorporated in this transit level, which is designed especially for contractors and is useful in all survey and check-up operations in building and road construction. The improved instrument comes complete

are you being taken for a buggy ride?

Is the high cost of materials and labor clouding your profit picture . . . endangering your customer relations?

To cost-conscious contractors and engineers, Rex Pumpcrete . . . *the pump that pumps concrete through a pipe line* . . . provides a proved way to substantially reduce costs!

For example! Think of the costs involved in buggying concrete! Figure the savings to be gained when you can eliminate the buggy run and deliver concrete through a pipe line right to the point of replacement.

Then! Figure how much you could cut your bids if you could be assured the fastest, most advantageous form and steel setting sequence . . . if you could achieve a closer coordination between the trades (carpenters, steel setters, concrete crews) and reduce interference with these interlocking activities.

Because Pumpcrete makes these advantages possible through steady pumping instead of the usual occasional pour, you can cut days off your schedule . . . and that means money in your pocket!

Add to these cost-cutting advantages, the fact that Pumpcrete transports concrete through a pipe line on one or more levels . . . elevates or lowers and distributes concrete in ONE operation. Thus, you can eliminate the expense of road building and maintenance . . . trestling and scaffolding . . . towers and many other items of preparatory work that add materially to construction costs.

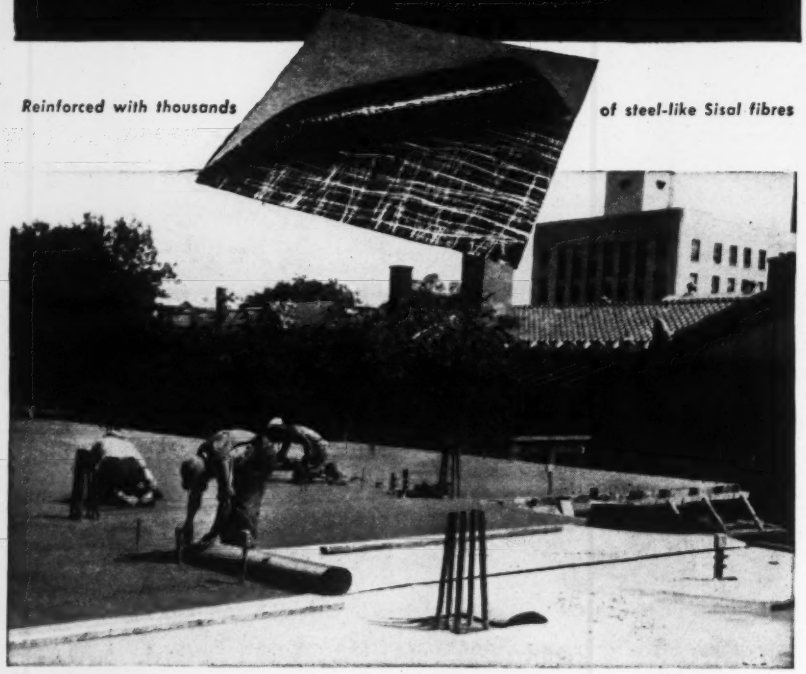
If you want to avoid being taken for a "buggy ride," talk to your Rex Distributor before you bid. He can show you how you can cut costs . . . improve concrete quality . . . make more money with "concrete by pipe line." If you prefer, write direct for free copies of informative Bulletins on Pumpcrete economy. Address Chain Belt Company, 1633 West Bruce Street, Milwaukee 4, Wis.

REMEMBER, Pumpcrete can now be rented from your Rex Distributor so you can prove the economy of pipe line placement for yourself at low cost!

CONSTRUCTION MACHINERY

MAXIMUM PROTECTION MINIMUM COST with SISALKRAFT

Reinforced with thousands of steel-like Sisal fibres



SISALKRAFT used for curing and protection of concrete floors of multi-story building

CLEAN and DUST-FREE FLOORS AT REDUCED COST!

SISALKRAFT is so strong it furnishes positive protection from debris and construction stains, and prevents marring. It also affords dependable frost-protection. It is so light-weight, it can be rolled into place easily and be removed quickly. Economical . . . can be used many times over.

The SISALKRAFT Method of curing and protection is used not only on buildings of concrete construction, but also, in a big way, on concrete highways. This modern method is automatic . . . no watching, no sprinkling, no other covering. The SISALKRAFT Method is a "natural" for you on single-story and multi-story jobs . . . also for driveways, sidewalks and roads. For complete data write Dept. ENR.

PROMPT DELIVERIES!

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Manufacturers of . . .

SISALKRAFT • SISALATION • COPPER ARMORED SISALKRAFT • FIBREEN • SISALTAPE

with a hardwood carrying case, sun-shade, dust cap, adjusting pins, plumb bobs, full length split-leg tripod, and instruction book.—*David White Co., Milwaukee, Wis.*

316

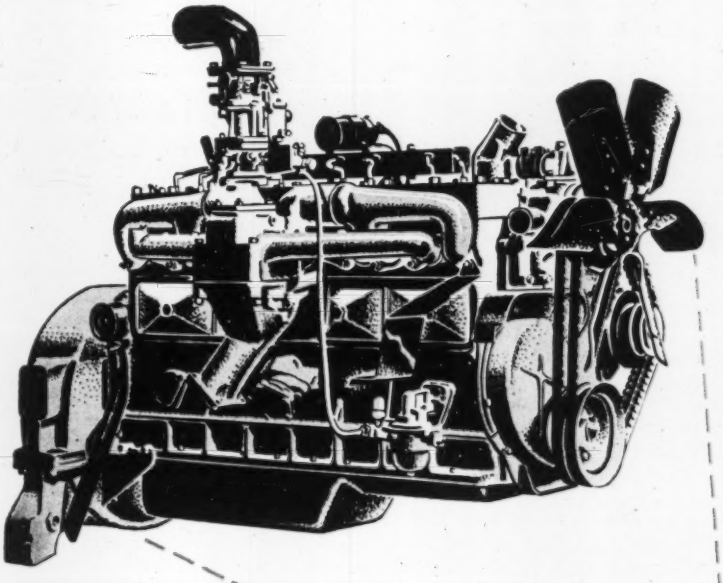
PAVING BREAKER — Designed to break concrete and other type of pavement up to 10 in. thick and tamp backfill. Mounted on a tricycle running gear and driven by air motor geared to wheels. Used with 105 c.f.m. air compressor, breaker delivers 55-60 blows per minute with 5000 ft.-lb. of energy available at striking head. Machine is 4 ft. 8 in. long, 4½ ft. wide and 5 ft. high. Mounted on all-welded frame, it has 3-in. piston rod, 5-in. cylinder bore and 125-lb. hammer. Normal stroke is 24 in. Machine weighs 1450 lb. and will reach 30 in. below ground surface. Seven types of paving breaker tools fit this machine, called the "Mighty Midget." It is adapted for making quick openings in pavement for public utility facilities.—*R. P. R. Corp., 2751 E. 11th St., Los Angeles, Calif.*

317

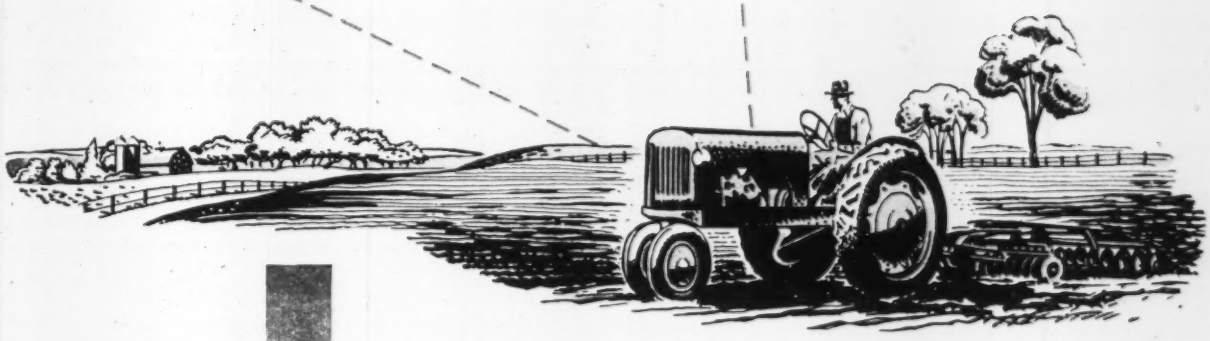
WELDING ELECTRODE — All-position arc welding electrode for mild steel available in 1/8, 5/32, 3/16, 7/32, 1/4, and 5/16 in. diameters. Operation satisfactory when welding vertically down. Minimum spatter with either a.c. or d.c. current. Deposited bead is strong, smooth, of proper contour and slag is easy to remove.—*Wilson Welder & Metals Co., Inc., 60 E. 42d St., New York 17, N. Y.*

318

SPONGE RUBBER STANDING MAT—Designed to reduce or relieve fatigue, foot discomfort, tired and aching leg and back muscles of workers who must stand for long hours, new sponge rubber standing mat is 3/8 in. thick, 20 in. long and 18 in. wide and weighs 3½ lb. For machine operators and others, new mat places a soft material between feet and floor.—*B. F. Goodrich Co., Akron, Ohio.*



FOR A BETTER DAY'S WORK



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See ad on page 123 for list of equipment in each line

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Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman Equipment Co.
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Cal., L. A. Golden State Equip. Co.
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Jacksonville, Ogden Equip. Co.
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Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
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N. Y., Buffalo, Murray Equip. Co.
New York, Hodge & Hammond, Inc.
Syracuse, Milton-Hale Mach. Co.
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N. D., Fargo, Smith, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
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Toledo, The Kilcorse Machy. Co.
Okla., Oklahoma City, Tattan-Douglas Equip. Co.
Oregon, Portland, Anderson Machinery

Pa., Bradford, Bradford Supply Co.
Wilkes-Barre, Ensminger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Hamilton Tractor Co.
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Dallas, Shaw Equip. Co.
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San Antonio, San Antonio Machy. & Supply Co.

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Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Buy Blue Brutes

Worthington Pump and Machinery Corp
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

Manufacturers' Publications

319

Form Accessories—An 8-page catalog illustrates and describes such form aids and accessories as clamps, tie rods, spirolocs, wrenches, nuts, rod pullers, spacing anchors, etc.—*Universal Form Clamp Co., 1238-56 N. Kostner Ave., Chicago 51, Ill.*

320

Sheet and Plate Alloys—A 48-page booklet gives technical information on various sheet and plate alloys, gages and sizes, also an analysis of costs of aluminum sheet and plate as compared with other widely used metals. There are brief discussions of formability, weldability, riveting and joining, brazing, soldering, machinability, and resistance to chemical attack. There are tables for computing accurately the weight of various sizes and thicknesses of sheet and plate items.—*Reynolds Metals Co., 2,500 So. Third Street, Louisville, Ky.*

321

Metal Joists and Windows—Bulletins give particulars of Ceco steel joists and roof deck and metal windows and doors. Illustrations, charts and installation details make this literature useful to builders. Perhaps the most valuable feature is the very complete set of safe load tables.—*Ceco Steel Products Corp., 5,701 W. 26th Street, Chicago 50, Ill.*

322

Structural Insulation—A bulletin tells all about Celotex Cemesto Board, a structural insulating material consisting of genuine ferox-treated Celotex cane fiber insulation board surfaced on both sides with 1/8-in. asbestos-cement board, light grey in color. A moisture-proof, highly vapor resistant bituminous adhesive bonds the asbestos-cement to the Celotex cane fiber core. The product is used both for exterior walls and for interior partitions. The Celotex Cemists roof decks an applicable to wood or steel framing.—*The Celotex Corp., 120 So. La Salle Street, Chicago 3, Ill.*

323

Wire Rope—An attractive, 2-color combination catalog and handbook has been issued by the Wire Rope Institute, representing most American wire rope manufacturers. The 119-page publication contains full information on the selection, purchase and use of wire rope, together with data on fittings and attachments, splicing and other related subjects.—*Wire Rope Institute, 1044 Shoreham Bldg., Washington 5, D.C.*

324

Open Steel Flooring—Catalog describe "Supergrate" and "Superweld", companion open steel floor gratings. "Supergrate" is fabricated to order and is a riveted type of grating. "Superweld" is pressure-welded and offers an accurately-dimensioned, one-piece flooring with a smooth, non-slip surface. The table of safe loads is a useful feature.—*Supergrate Open Steel Flooring Co., 730 East 59th Street, Los Angeles 1, Calif.*

325

Caulking Compound—A 15-page booklet describes Bond-o, a jointing compound composed of sulphur and other inert minerals used to joint cast iron bell and spigot water pipe. It weighs only 25 percent as much as lead and is self-caulking. It is said to remain tight when subjected to expansion and contraction on account of excessive temperature changes. It makes dependable joints in water mains of any size.—*Northrop & Co., Spring Valley, N. Y.*

326

Building Panels—"Fenestra Building Panels for Up-To-Date Houses" is the title of a new folder in which information is provided about Fenestra steel panels that combine joist, bridging and subflooring. Use of these panels in connection with radiant heating is one of the subjects discussed.—*Detroit Steel Products Co., 3159 Griffin St., Detroit 11, Mich.*

327

Conveyor Belts—A new catalog section dealing with the proper selection of conveyor belt grades has just been published. It explains the yardstick employed in belt engineering to differentiate grades, pictures and describes the conveyor belts in its line, cites the common application for each and also devotes a page to special construction obtainable in the various grades.—*The B. F. Goodrich Co., Akron, Ohio.*

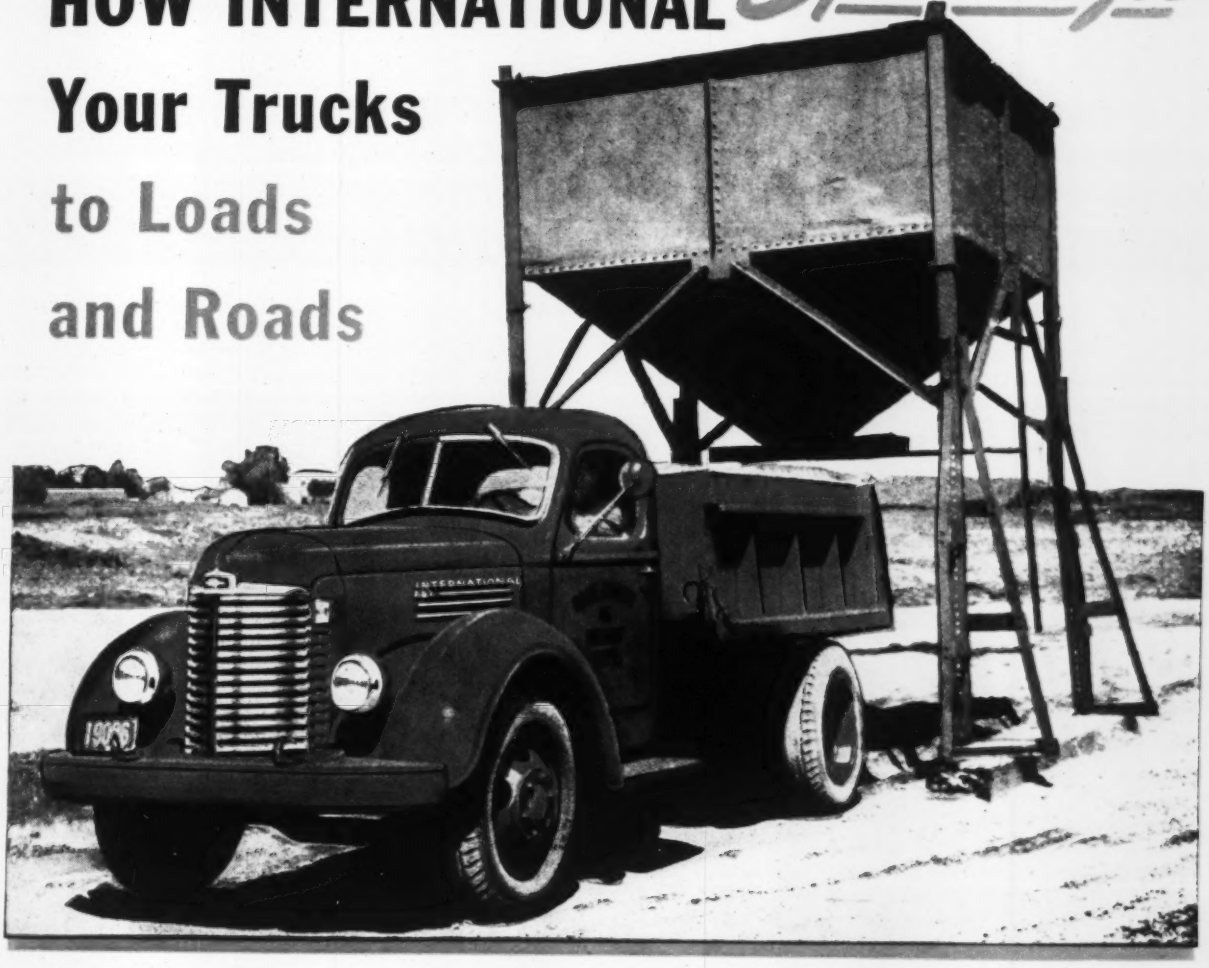
328

Manganese Steel Chains—A 28-page booklet tells of austenitic manganese steel and its characteristics, and shows the advantages of manganese steel chain for tough jobs involving shock and abrasion such as for elevators, conveyors, dredging and dragline.—*American Manganese Steel Division of American Brake Shoe Co., Chicago Heights, Ill.*

(*Continued on page 126*)

HOW INTERNATIONAL *Specializes*

Your Trucks to Loads and Roads



This first step is an analysis of your hauling problem by your International Dealer or Branch.

This analysis includes type of load; method of loading; terrain and grades; and length of hauls.

The amount of payload practicable for your trucks then is determined by the exclusive International Truck Point Rating System.

Your Internationals then are *specialized*—engine power, transmissions, axle ratios and other units and attachments—to fit your trucks to your jobs.

What does this *specialization* add up to?

1. Ability to do *your* hauling jobs right. 2. Dependability. 3. Economical operation. 4. Low maintenance. 5. Long truck life.

The International Truck Line is the most complete line built. It includes 22 basic models that *specialize* into more than 1,000 different types of trucks. Gross weight ratings are from 4,400 to 90,000 pounds.

For details of International Truck *specialization*, and analysis of your jobs by the International Point Rating System, consult your International Dealer or Branch.

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International Truck Branches located at San Diego, Los Angeles, West Los Angeles, Glendale, Fresno, Sacramento, Oakland, San Francisco, Portland, Tacoma, Seattle, Spokane, Salt Lake City, Denver, Cheyenne, Billings and Great Falls.

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INTERNATIONAL *Trucks*

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BRIGGS & STRATTON
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BUILD THE WORLD'S FINEST
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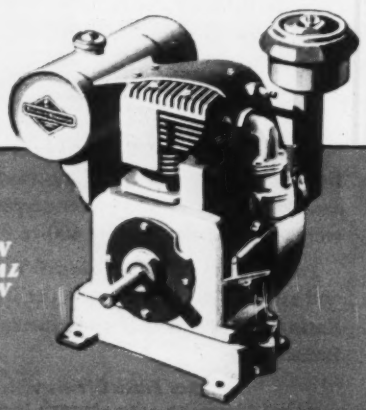

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★ AIR-COOLED POWER

Briggs & Stratton plants are equipped with the most modern machines, tools, and inspection facilities, designed for precision mass production. Operating this equipment are thousands of experienced and skilled men and women who take pride in their workmanship, and the part they have in building "The World's Finest Air-Cooled Gasoline Engines."

The record established by over 3½ million Briggs & Stratton engines, used in all parts of the world, is gratifying proof of their unequalled, built-in dependability.

When you specify Briggs & Stratton Air-Cooled Power, you are assured maximum engine performance year after year.

BRIGGS & STRATTON CORPORATION, Milwaukee 1, Wisconsin, U. S. A.

329

Anti-rust Paint—(6-p. leaflet) Presents application directions for Rustre and emphasizes that this paint can be applied directly over rusty surface without wire-brushing or scraping. Recommended for automotive and construction equipment use on any metal surface subject to rust. Paint is available in black or aluminum.—*Speco, Inc., 5142 Superior Ave., Cleveland, Ohio.*

330

Concrete Floor Repairs—(4-p. leaflet) Smooth-on is a quick-hardening iron cement for speedy and economical patching of cracks, ruts and shallow holes in concrete floors. Expands slightly as it hardens so as to wedge finished patches tightly in place.—*Smooth-on Mfg. Co., 570 Communipaw Ave., Jersey City 4, N. J.*

331

Hydraulic Power Unit—(4-p bulletin) Midget size hydraulic power unit named "Ten-Ton Tony" is intended for use on farm and road machinery for pushing, pulling or lifting. Measures 6x7x9-in. overall. Equipped with rugged gear pump. Requires only 2½ hp. to operate. Built-in 4-way operating valve permits use of double acting ram. Has capacity of 3 gal. of oil per minute at 1200 rpm. at 1,000 psi.—*Hydraulic Press Mfg. Co., Springfield, Ohio.*

332

Sand and Stone Handling Equipment—(64-p. booklet) For handling and preparing sand, gravel and stone. Subject matter covers all types of elevators and conveyors, vibrating and revolving screens, washing and dewatering units. Also mobile shovels, cranes, draglines, portable conveyors, loading spouts and gates, chain drives, speed reducers, and variable speed changers. Intended for information of sand, gravel and stone plant operators is Book No. 2126.—*Link-Belt Co., 307 No. Michigan Ave., Chicago 1, Ill.*

333

Truck Loader—(4-p. folder) Bucket on swinging arm loads truck from rear end. Power is furnished by traction of truck's rear wheels on loader pads.—No power takeoff required.

333-A

Scrapers—(16-p. pamphlet) Devoted to problems of earth moving. Describes loading, hauling and spreading jobs with scrapers of three sizes hauled by Caterpillar track-type tractors. Publication is entitled "Caterpillar Scrapers at Work."—*Caterpillar Tractor Co., Peoria 8, Ill.*

334

Utility Pumps—A circular gives facts on a new self-priming centrifugal pump especially built for utility company service. It is claimed that priming is automatic on suction lifts up to 25 ft. high. They are misers on fuel. —*Marlow Pumps, Ridgewood, N. J.*

335

Form Clamps—(illustrated circular) Describes Uni-Form system of wall form construction. Also deals with form clamping and tying devices and other accessories for reinforced concrete construction.—*Universal Form Clamp Co., 1238-56 No. Kostner Ave., Chicago 51, Ill.*

336

Rubber Base Enamels for Concrete Floors — (Leaflet) One-hour drying enamel is intended to reduce accidents caused by skidding on floors. Cost is claimed to be one cent per square foot. Is resistent to washing chemicals.— *Wilbur & Williams Paint Corp., 43 Leon St., Boston 15, Mass.*

337

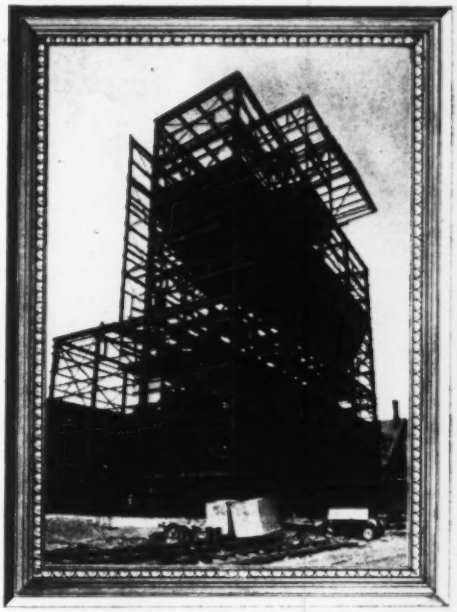
Concrete Condition Survey—(42-p. booklet) Reports results of inspection of structures built with Incor high-early-strength portland cement concrete and in service for periods up to 20 years. Results cover wide range of concrete work and exposure conditions and are offered as a cross section of Incor performance.—*Lone Star Cement Corp., 342 Madison Ave., New York 17, N. Y.*

338

Insulating Concrete—These advantages of this product are given in a circular: permanence, incombustibility, economy, light weight and proof against rot. Photographs show typical short span structural roof decks, and specifications are given.—*Universal Zonolite Insulation Co., 135 So. LaSalle Street, Chicago 3, Ill.*

339

Air Sanitation—An engineering and application data book outlines the operation of air recovery equipment used in the conversion of stale, vitiated, or contaminated air to its original freshness, either to conserve it for re-use or to correct exhaust and intake odor nuisances. The equipment consists of hollow-walled cylindrical canisters containing specially processed activated carbon and a manifold or supporting plate in which the canisters are secured.— *W. B. Connor Engineering Corp., 114 East 32d Street, New York 16, N. Y.*



Rock wool plant for National Gypsum Co., Dover, N. J.

MORE than a MATCH for TIME

Of all building materials, structural steel is least affected by the ravages of time. Ingalls has supplied high-grade fabricated steel to the building industry for many years . . . for skyscrapers, bridges, industrial buildings, power plants, gymnasiums. Engineers and contractors know that Ingalls steel is fabricated to exact specifications . . . that it goes up with a minimum of erection time and cost.

For strength and endurance, specify structural steel. For performance and dependability, specify Ingalls.

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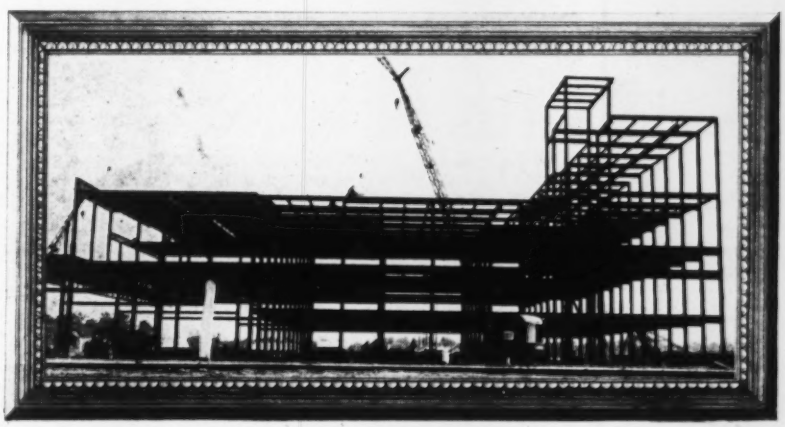
STEEL

THE INGALLS IRON WORKS CO., THE INGALLS SHIPBUILDING CORP., The Steel Construction Co., Birmingham Tank Co. Offices at BIRMINGHAM, Pittsburgh, New York and New Orleans. Fabricating plants at Birmingham, North Birmingham, Verona, Pa., Pascagoula, Miss., and Decatur, Ala.

du Pont Nylon plant at Chattanooga, Tenn.



Wanted 10 SALES ENGINEERS

A large midwestern manufacturer has opening for ten capable men who meet the following requirements:

EXPERIENCED SALES ENGINEERS—(75% of time travelling)

Age—30 to 45

Experience: Sales, application, or administrative in heavy construction or earthmoving, crane or allied industries, preferably representing manufacturer in the field.

Education: Civil or mechanical engineering graduate desired. (Comparable experience acceptable in lieu of formal education)

FIELD ENGINEERS—(Some domestic travelling)

Education: Degree in Civil or Mechanical engineering required. Recent College graduate preferred.

Experience: Heavy construction, earthmoving or highway engineering.

Trainees:

Will consider young recent civil or mechanical engineering graduates for both sales and field engineering trainees.

Salary plus expenses

Describe in detail experience and qualifications, indicating position interested in. Replies confidential. Our employees know of this advertisement. Address reply:

S.W.-4507, Engineering News-Record,
330 West 42nd Street, New York 18, N. Y.

OPERATING machinery for bridge installations, dams, locks and gates should be dependable and positive in action above all else. Earle "oversize" construction and automatic lubrication minimize wear and provide year after year service with little or no maintenance. Backed by years of experience, Earle produces operating machinery that is known as "trouble-free" by bridge and water works engineers who specify it.

Our specialists will gladly work with you to solve your gear or machinery problems—get in touch with us now. If you want further information first, send for our NEW catalog containing Earle operating machinery. The EARLE GEAR AND MACHINE CO., Main Office: 4717 Stenton Ave., Phila. 44, Pa.; Sales Offices: 149 Broadway, N. Y. 6; 901 Davis Ave., Pittsburgh 12, Pa.

INCORPORATED IN EARLE OPERATING MACHINERY

EARLE GEARS

Men and Jobs

Seattle and Tacoma, Wash., have appointed new city engineers, each of whom comes from the state highway department. In each case the former city engineer will continue as consultant.

Ralph W. Finke, head of the bridge division of the state highway department for the last nine years, takes the Seattle position. He succeeds Charles L. Wartelle, who retired because of ill health after 10 years as head of the city department. Mr. Finke is a 1926 civil engineering graduate of the University of Washington and has been with the state highway department since 1931.

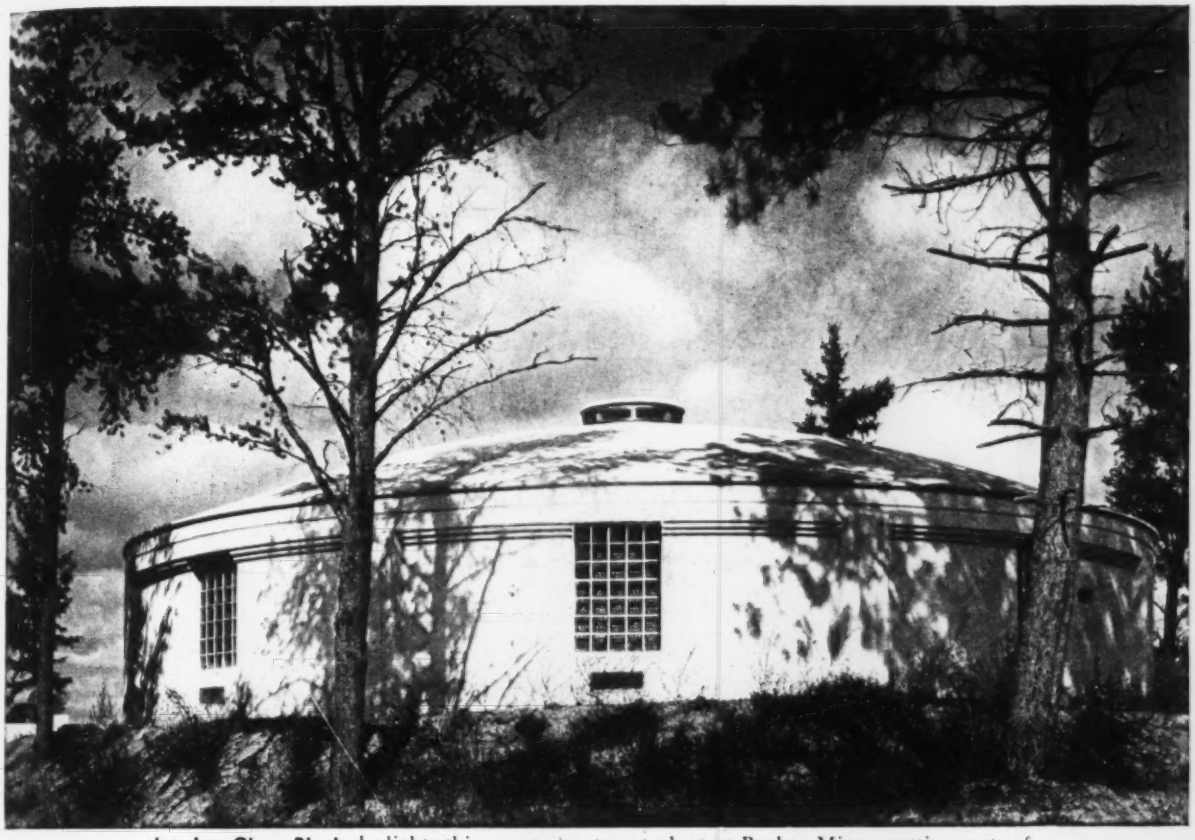
The Tacoma position went to **D. E. Morris,** state traffic engineer since 1942. He is a graduate civil engineer of Oregon State College, 1931. During vacations from school he worked on survey crews of the former Bureau of Public Roads. He began with the Washington state highway department as a transitman, served next as location and resident engineer at Spokane, then was transferred in 1935 to Wenatchee as district office engineer. When Burwell Bantz, whom Morris succeeds as Tacoma city engineer, became state highway engineer, he transferred Morris to Olympia in 1942 as assistant traffic engineer.

D. E. Morris

Robert B. Mitchell has resigned as executive director of the city planning commission of Philadelphia, Pa., to become research professor in the Institute of Urban Land Use and Housing Studies at Columbia University.

Edwin S. Bundy has been made a vice-president and chief engineer of the Niagara Hudson Power Corp. He has been a director, vice-president and chief engineer of the Buffalo Niagara Electric Corporation and has held various engineering jobs with the electric utilities of Western New York for 36 years.

Kermit B. Rykken, St. Paul, has been appointed manager of the Minnesota Statewide Highway Planning Survey by M. J. Hoffmann, Highway Commissioner. Mr. Rykken received his

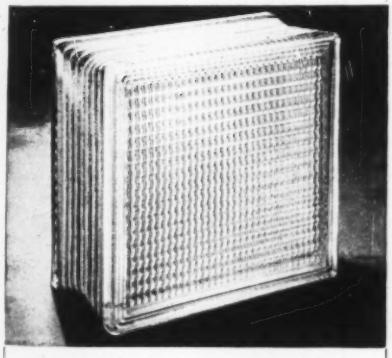


Insulux Glass Block daylights this sewage treatment plant at Bagley, Minn., cutting costs of maintenance and reducing sanitary hazards. Engineers: Druar & Milinowski, St. Paul, Minn.

Why daylight a sewage plant with Insulux?

IF YOU think of Insulux Glass Block only in terms of its decorative value, you may well ask yourself that question.

Insulux, however, is primarily a functional material. It is designed to do things which other building materials cannot. For example, it transmits light, insulates, reduces condensation and cuts maintenance costs to a minimum.



INSULUX
GLASS BLOCK
AMERICAN STRUCTURAL PRODUCTS COMPANY
Subsidiary of
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In the sewage treatment plant shown above, Insulux Glass Block was selected because it is simple to maintain. Insulux panels answer sanitary problems to perfection by furnishing a flush, light-transmitting surface which requires little or no maintenance. Insulation value helps, too—reduces condensation which otherwise causes rapid deterioration of other materials.

The qualities which make Insulux Glass Block valuable in this application may apply to your business, also. Mail coupon today for informative free booklet(s).

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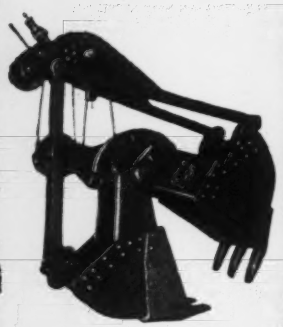

WELLMAN
Williams Type
Welded Buckets

Operators prefer the Wellman Bucket for its balance, easy handling, and digging power. Owners prefer the Wellman Bucket for its bigger payloads, lower maintenance cost. These features are not accidental. Wellman pioneered in welded construction of rolled steels which make these buckets lighter, stronger, for greater yardage at lower costs. In all types and sizes, you'll do better with a Wellman!

There's a Wellman Bucket for every service

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education at the University of Oklahoma. He has been a statistician with the Survey since its inception in 19[illegible] excepting 1943 through 1945 with the U. S. Army Engineers in the Pacific area. He has been manager of the Survey's Traffic Section since 1940.

J. C. Handshoe, civil and structural engineer, has been appointed structural engineer for Masonite Corp., at Laurel, Miss. He was formerly associate bridge engineer with the State of California. Prior to that he was connected with Ebasco Services Inc. as valuation and structural design engineer. He has also served with E. I. du Pont de Nemours, Koppers Co., E. B. Badger & Sons Inc., and others.

Don Akins, civil engineer of Ellensburg, Wash., has sold his interest in a farm equipment distribution business there and is returning to contracting. He served five years with the Army Engineers in the Portland, Ore., district as construction supervisor, then was a project engineer for The Austin Co. on Whidbey Island naval projects for three years, and served as a construction engineer for the Navy on a Bremerton, Wash., railroad project.

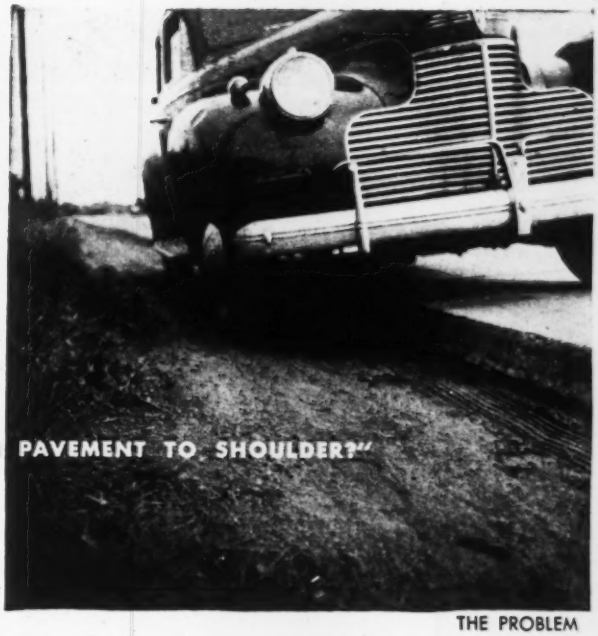
The common council of White Plains, the county seat of Westchester County, N. Y., on May 3 held a special meeting as a testimonial to **Eugene Halpin, Jr.,** for 24 years commissioner of public works of that city, who is retiring after 40 years of public service. One of the speakers was Richard E. Dougherty, president of the American Society of Civil Engineers, who called attention to the fact that during his tenure of office Mr. Halpin had supervised the rebuilding of the entire water storage and distribution, sewage disposal, storm water drainage, and thoroughfare systems during the period of rapid growth to a city of 45,000 population.

Merit Penniman White, formerly assistant professor of civil engineering, Illinois Institute of Technology, and recently engineering consultant to the U. S. War Department, has been appointed professor of civil engineering at the University of Massachusetts.

Gustav Stueber and **V. Carl Trageser** have bought a building at 539 Carson Street, South Side, Pittsburgh, Pa., and will conduct there their business as industrial engineers and constructors.

"Are any of your roads too narrow?

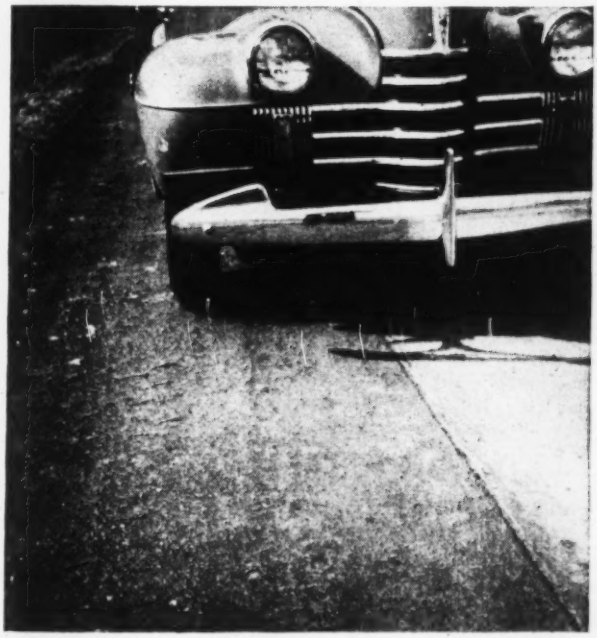
. . . OR HAVE THEY DANGEROUS DROPS FROM PAVEMENT TO SHOULDER?"



THE PROBLEM

Roads too narrow to carry today's fast-moving traffic safely and satisfactorily may be swiftly and economically widened with Tarvia* road tar or Tarvia-lithic* bituminous concrete. The methods are simple and inexpensive, and there are combinations of Tarvia* road tar and aggregate which are adaptable to any kind of road and any condition of shoulder areas.

THE SOLUTION



Dangerous drops between pavement and unfinished shoulder are done away with, and the widening not only extends the life of the road but also increases the amount of traffic it can safely accommodate.

Why not check the narrow roads in your locality? The Barrett field man can advise the proper shoulder foundations and wearing surfaces, and he will be glad to work with you.

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"IT'S BEAUTIFUL, YES— BUT WILL IT RUST?"

Fabricators are learning that Hot-Dip Galvanizing gives added value, better appearance, and greater service to their metal products.

The Hot-Dip Method of bonding protective zinc to metal, as consistently followed by the members of the American Hot Dip Galvanizers Association, *positively* seals in metal and seals out rust and corrosion.

Each member of this Association, pledged to follow the highest standards in the Hot-Dip Galvanizing industry, has at his disposal the accumulated experience of the entire membership, the newest in equipment, and assures you the highest quality in workmanship and materials.

Write the Secretary, American Hot Dip Galvanizers Association, Inc., First National Bank Building, Pittsburgh, Penna., for membership roster.

hot-dip GALVANIZING

Elections and Activities

The Corporation of Professional Engineers of Quebec has elected: J. B. Stirling, president; J. A. Lallonde, vice-president; L. W. Blayton, secretary-treasurer, and as councilors: F. S. Howes, J. A. H. Henderson, Leo Dufresne, Aldrien Pouliot, and Gerard Letendre.

F. R. Everds, of Esterville, has been elected president of the Iowa Gravel Contractors Association. Board members are B. L. Anderson, Cedar Rapids; Roy Potthoff, Des Moines; Dick Paul, Fort Dodge; L. R. Falk, St. Ansgar; and Vern Robson, Early.

Officers of the Wisconsin Chapter, American Society of Sanitary Engineers, are George Farndale, Milwaukee, president; O. E. Pressentin, Madison, vice-president; and A. J. King, Milwaukee, secretary-treasurer.

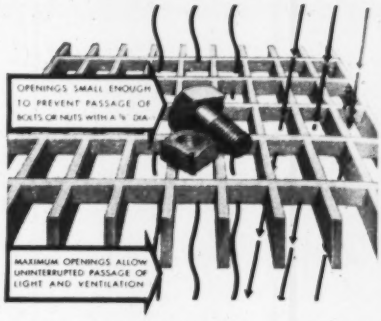
At the recent election of the Association of Professional Engineers, of Alberta, Canada, C. S. Clendining, district manager, Lethbridge Northern Irrigation District, stepped up from the vice-presidency to succeed I. S. Irwin as president, and Dean R. M. Hardy, of the Faculty of Applied Science of the University of Alberta, was elected vice-president.

W. W. Perry, chief engineer, Saskatchewan Public Works Department, has been named chairman of the Northwest International Highway Association. W. M. Stewart, provincial maintenance engineer for Saskatchewan, is secretary-treasurer. Directors include A. Frame, highway commissioner for Alberta; Walter Youngman, assistant chief engineer for Manitoba, and Evan Jones, B. C. district engineer at New Westminster.

E. D. Fry, superintendent of the Greenville sewer district has been elected president of the South Carolina Waterworks and Sewerage Association. J. W. Logan was named vice-president, and W. T. Linton of Columbia, secretary-treasurer.

W. Albert Hogle, who organized the Northwest Ohio Drainage Association eleven years ago, has been elected president, succeeding T. K. Priddy, Van Wert County engineer. Others elected were: Deloss Nissen, Port Clinton, first

Tri-Lok RECTANGULAR OPEN STEEL FLOORING


OPENINGS SMALL ENOUGH TO PREVENT PASSAGE OF BOLTS OR NUTS WITH A ½" DIA.
MAXIMUM OPENINGS ALLOW UNINTERRUPTED PASSAGE OF LIGHT AND VENTILATION

Tri-Lok strength is obtained by truss action through twisted cross-bar, curved in opposite directions at each bearing-bar. Standard openings in Tri-Lok Rectangular Steel Flooring are 1" x 3⅞"—other size openings can be supplied as required.

Diagonal, or Super-Safety U-type Flooring, and stair treads of all types, are available. Bulletin KC 1140 describes the construction features of Tri-Lok Open Steel Flooring.

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Keep that Water Level

THE RIGHT PUMPS WELLPOINTS SUPERVISION AND KNOW-HOW

TO DRY YOUR JOB

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P&H SINGLE PASS SOIL STABILIZERS

● On this soil-bituminous state highway in Texas, a P&H Stabilizer with one operator processed on an average of 8,000 square yards per day in a single pass. Maximum production often reached 1,200 square yards per hour!

There's little that's unusual in the speed of this Texas job. Such reports are being received from all over the country — where P&H Single Pass Soil Stabilizers are at work building excellent, all-weather surfaces more quickly.

Making maximum use of in-place materials, the P&H Stabilizer performs with accurately predetermined results, *all 8* basic requirements of soil stabilization — and does it with any type admixture and at a rapid pace.

If you build secondary highways, streets, base courses, airport runways, etc., you should investigate the P&H Single Pass Soil Stabilizer. Ask for information.

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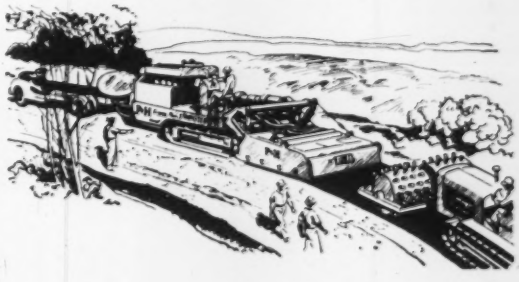
FACTS ABOUT THE JOB! . .

Location of Project — State highway 274, Henderson County—from Tool to Kaufman County line.
Length of Project — 7.68 miles.
Width of Roadway — 20 feet (2 lanes of 10 feet each).
Type of Soil — Loamy sand.
Stabilizing Agent — 4 gal. cracked fuel oil per sq. yd.
Rate of Production — Average 8,000 sq. yds. per working day.

NEW MOTION PICTURES!

If you would like to see a P&H Stabilizer at work processing soil-stabilized roads — learn how it does it — write us for showing of full color, sound motion pictures. One covers soil-cement and the other soil-bituminous work.



Twin Disc Spring Loaded Clutch

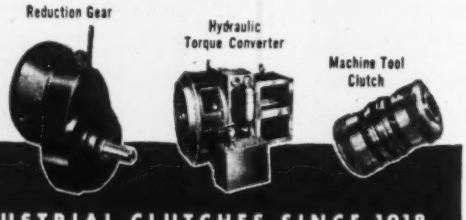
Manufacturers who use Twin Disc Spring Loaded Clutches include:

- Chicago Pneumatic Tool Company
- Davey Air Compressor Company
- Jaeger Machine Company
- LeRoi Company
- Schramm, Incorporated
- Novo Engine Company
- Gardner-Denver Company
- Sullivan Division of Joy Mfg. Company

To eliminate the need for constant adjustment and to minimize clutch failures, most manufacturers of portable air compressors use Twin Disc Model SLT Spring Loaded Clutches. Specifically designed for air compressors, the Spring Loaded Clutch provides a durable coupling in this exceedingly rugged service.

A positive drive . . . free from burning and slippage . . . is assured by connecting the engine and the compressor through the medium of this Twin Disc hand-operated Clutch. Being spring loaded, the Model SLT Clutch eliminates the need for frequent maintenance. Single point adjustment is incorporated to compensate for wear on the molded asbestos driving plates and to provide for seasonal readjustment.

Write for complete information on how you can apply Twin Disc Spring Loaded Clutches to your air compressor. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

vice-president; Robert Eastman, Springfield, second vice-president; and Truman Woodworth, Findlay, secy-treas.

C. C. Redmond, Jr., of Kennett, has been elected president of the Missouri Highway Engineers' Association. Other new officers are: vice-presidents, F. E. Ross of Jefferson City and Ben Prater of Harrisonville. Re-elected were: vice-presidents Frank F. Newton of Joplin and H. E. French of St. Louis, and secretary-treasurer, J. J. Corbett, Jefferson City.

Two New Yorkers, W. W. Caldwell of Caldwell-Scott Construction Co. Inc., and R. P. Bayard, of Johnson, Drake and Piper, Inc., have been named members of the 8-man 1948 committee on public relations for the Associated General Contractors of America by D. W. Winkelman, Syracuse, N. Y., president. Caldwell and Bayard will serve with C. P. Street, Charlotte, N. C.; Gayle Armstrong, Roswell, N. M.; George E. Dolph, Dallas, Tex.; Dan W. Kimball, Grand Rapids, Mich.; William D. Rapp, Santa Rosa, Calif., and A. L. Atherton, Seattle, Wash.

Col. Paul D. Berrigan, district engineer, Kansas City, Mo., has been re-elected president of the local post of the Society of Military Engineers. Other officers are: M. M. Gambrel, vice-president; J. W. Walker, secretary; Robert M. LaFollette, treasurer; and Harry Darby, James J. Downey, George R. Fiske, Harold M. Brush and E. K. Carter, directors.

Captain George A. Worth of Fort Bragg, N. C., was elected president of the 238th Engineer Combat Battalion Association at its second annual meeting at Winston-Salem, N. C., April 24, succeeding Ray Transou of Winston-Salem. The association, which has some 700 members in 46 states, voted to meet in Nashville, Tenn., next year.

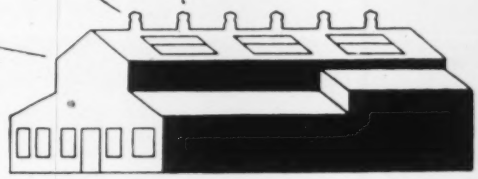
Officers and directors of the Westchester County, N. Y., chapter of the N. Y. State Society of Professional Engineers have been elected as follows: President, Chester A. Garfield, Bronxville; 1st vice-president, Lloyd C. Medcalf, White Plains; 2nd vice-president, Richard M. McLaughlin, White Plains; secretary, Raymond Willsea, Dobbs Ferry and treasurer, Wilson W. Scott, Mount Vernon.

Directors: George A. Noren, White Plains; Norman S. Odell, Mount Vernon; Vincent G. Terenzio, New York; Ebbert Pearson, Chappaqua; Raymond N. Poole, Peekskill; John J. Balint, Yonkers; Jackson H. Taylor, Scarsdale; Max Vogel, Rye and John A. Weyant, Yorktown Heights.

1. Construction delays are retarding industrial expansion

2. Construction costs are taking bigger capital outlays

3. Process changes are making "heavy" building obsolete



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1. *Speeds up Building.* With roofing and siding of Koppers Plastipitch Protected Metal, permanent, durable industrial buildings can be erected faster.

2. *Keeps Down Costs.* The protective coatings of Koppers Plastipitch Protected Metal Sheets make interior and exterior painting and recoating unnecessary for a long period of years, which means lower maintenance costs.

Koppers Plastipitch Protected Metal Roofing and Siding are not affected by most chemical fumes or salt air spray and are particularly resistant to all types of weather.

3. *Makes Alterations Easier.* Because of the constant change of production methods it is often advisable to alter industrial buildings. This can easily be accomplished by the use of Koppers Plastipitch Roofing and Siding.

30 pounds of tough, flexible Koppers Plastipitch Coatings per square protect the steel sheets from rust or corrosion . . . have an insulating effect which cuts down condensation. Where the sheets lap, the Plastipitch Coatings tend to adhere to each other and make a tight, weatherproof seal which prevents leaks.

These sheets are available flat, corrugated or V-crimped. Field cuts can be made and protected with Koppers Touch-up Compound. All straps, flashings, gutters, downspouts can be provided with the same Plastipitch protective coatings.

Send for the engineering manual on Plastipitch.

This cut-away view shows the protective coatings that prevent corrosion of Plastipitch sheets and make painting unnecessary for long periods of years.

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KOPPERS SUPPLIES MANY KINDS OF WATER-REPELLENT, CORROSION-RESISTANT COATINGS.

(1) Coal-tar pitch roofing
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and other metal, concrete, masonry and insulation. (3) Plastipitch Protected Metal for roofing and siding of industrial and farm buildings
(4) Coal-tar waterproofing and dampproofing.

★ The above picture of a small Sauerman Scraper digging gravel from pit and delivering to crushing plant shows the simple effectiveness of this method. This Sauerman machine uses 4½ gals. of gasoline to move 45 cu. yd. of material per hour.

YOU CAN SAVE

with

POWER SCRAPERS and CABLEWAYS

SAVINGS in equipment cost, time and labor are your direct gains on dig-and-haul jobs with a Sauerman Scraper or Cableway.

ONE-MAN CONTROL, fast and positive action. Reaches across a river, pond, pit or stockpile, or to top of hill—moves material from any point within cable radius, and dumps automatically wherever desired.

Whether you handle a few tons a day, or many thousand tons, we can supply size and type of equipment that will meet your exact requirements economically. It will be built to give you years of service and require little by way of repairs.

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More than 50 years of leadership and experience in developing special purpose cloths for industry. With such a background of experience it is little wonder that Holliston Tracing Cloth is second to none. Try PEL-X.

When a company that for 50 years has specialized in the finishing of cloth to fit the specialty needs of Industry and the technical professions, says that their Holliston PEL-X Tracing Cloth has superior Qualities — and are anxious to supply samples to *prove* that these qualities actually exist, it's good business for draftsmen and purchasing agents to accept such an unselfish offer.

Test Holliston PEL-X for maximum uniform transparency, ready erasability, minimum feathering, sharper blueprints, and a truly high resistance to moisture and perspiration. Test for speed. Test for saving in time and labor costs. You be the sole judge. We are confident you will be glad you wrote for a generous sample.

THE HOLLISTON MILLS, INC.
CHICAGO NORWOOD, MASS. NEW YORK

Manufacturers' Activities

Current developments among manufacturers relating to expansion of services, shifts in personnel, and other changes, include the following:

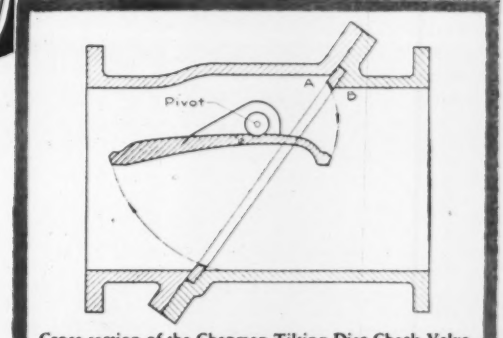
Sales—H. M. Albers has been appointed assistant sales manager of the KINGSTON STEEL CO., Chicago. . . . Three new sales engineers for the PACIFIC CAR and FOUNDRY CO., Renton, Wash., are James M. Miller, Jr., North Sacramento, Calif.; Robert J. Sinclair, Philadelphia, Pa.; and Wayne Lindgren, Savannah, Ga. . . . John Walker is manager of the off-highway and mining truck sales of MACK TRUCKS, INC. . . . A. S. Rairden is wire rope sales manager for THE COLORADO FUEL and IRON CORP. and E. L. Klingler, assistant . . . O. W. Bynum is general sales manager of CARRIER CORP. Syracuse, N. Y. . . . Doswell O. Winton is regional sales manager for ALL-STATE WELDING ALLOYS CO. INC., White Plains, N. Y. . . . Robert A. Cooper is field engineering and sales representative in northern New Jersey for LIQUID CONDITIONING CORP., Linden, N. J. . . . Samuel H. Gifford is sales representative of WAYNE CRANE division, AMERICAN STEEL DREDGE CO. INC., Fort Wayne, Ind. . . . Wm. J. Faulkner has resigned as industrial sales manager of the ALLIS-CHALMERS TRACTOR division to become vice-president and part owner of FRANTZ TRACTOR CO., Allis-Chalmers' New York dealer.

Personalities—M. H. Courtenay has been appointed Atlanta Ga., district manager of SKF INDUSTRIES, INC. . . . John F. D. Rohrback has been elected president of RAYBESTOS-MANHATTAN, INC., succeeding Sumner Simpson, now chairman of the board and of the finance committee. . . . Harry Bernard replaces W. M. Walworth, resigned, as chief engineer of MACK TRUCKS, INC. . . . New vice-presidents of CUMMINS ENGINE CO. INC., Columbus, Ind., are L. W. Beck, D. J. Cummins and W. M. Harrison . . . A. E Cutter has been appointed superintendent of PITTSBURGH PLATE GLASS CO.'s Pittco store front metal producing plant at Kokomo, Ind. succeeding C. J. Bristow, retired . . . John H. White, Jr., has been appointed vice-president and general manager of the RODIC RUBBER CORP., New Brunswick, N. J. . . . Thomas T. Parker, for 19 years engineer with the BY-PRODUCTS STEEL CORP., a subsidiary of LUKENS STEEL CO., Coatesville, Pa., is now pressed metal manufacturing engineer with the HYSTER CO., Port-

HAVE A *Cushioned Closing* WHICH MINIMIZES WEAR

The balanced hinge-pinned disc in each Chapman Tilting Disc Check Valve is so designed that it closes without slamming or rubbing . . . cushioned by the effect of the stream against the short flap. This means that wear on seats, bearings, and hinge pins is minimized and pipe-line hammering is prevented.

Head losses are cut to about a quarter of those experienced with conventional types of check valves, and substantial power savings are possible when these valves are installed on pump discharge lines.



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

Chapman Tilting Disc Check Valves are available in iron or steel.

Send for bulletin containing complete information.

THE CHAPMAN VALVE MFG. CO.
INDIAN ORCHARD, MASS.

Visit the CHAPMAN EXHIBIT at the American Water Works Association CONVENTION

High Humidity IN BUILDINGS?

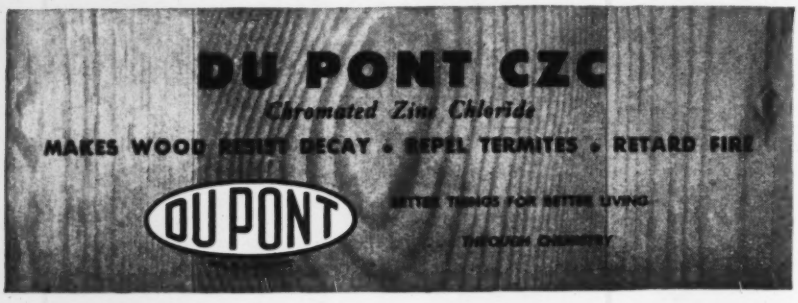
Prevent decay with "CZC"-treated wood

Moisture-laden air provides ideal conditions for the growth of decay fungi, but these fungi can't flourish in wood that's been treated with "CZC." Du Pont Chromated Zinc Chloride protects wood—gives it years of additional life.

Wood that has been pressure-impregnated with "CZC" has many other advantages, too. It resists termites, retards fire, is clean, paintable, and easy to handle.

You'll find that maintenance costs are cut to a minimum—costly repairs and replacements are eliminated—wherever "CZC"-treated wood is used. E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Wilmington 98, Delaware.

"CZC"-treated wood prevents decay in textile mill roofs where humidity is high.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land, Ore. . . . E. T. F. Wohlenberg has been appointed general manager of MASONITE CORP.'s new properties in Mendacino County, Calif. . . . Webster B. Todd has been appointed to the executive committee of AMERICAN WHEELABRATOR & EQUIPMENT CORP., Mishawaka, Ill. . . . George M. Hansen has been added to the trade extension staff of the WEST COAST LUMBERMAN'S ASSOCIATION . . . H. V. Huleguard has resigned as vice-president and general manager of the WHITCOMB LOCOMOTIVE Co., subsidiary of THE BALDWIN LOCOMOTIVE Co. and will continue to live at Rochelle, Ill.

Deceased—Ellsworth G. Mandt, 58, Birmingham, Ala., district branch manager of the JAEGER MACHINE Co., Columbus, Ohio, died in Birmingham April 20 . . . Allan E. Goodhue, vice-president and director of CHICAGO PNEUMATIC TOOL Co., New York, died April 20 . . . Swen W. Nelson, manager of the Buffalo, N. Y., office of BAILEY METER Co., died April 12.

Distributors—Elmer B. Kelly has been appointed district representative on motor graders and rollers for the GALION IRON WORKS & MFG. Co., in Indiana, Michigan, and the northern half of Illinois . . . E. L. Kessler and A. E. Simon, 1545 Exchange Ave., Oklahoma City, Okla., have been named distributors for R. G. LE TOURNEAU, INC. for Oklahoma . . . BUCHANAN Co., Kansas City, Mo., has been appointed sales agent for Lima shovels, cranes and draglines in Oklahoma, Kansas and western Missouri.

Miscellany—JOHNSON METAL PRODUCTS Co., Erie, Pa., has been merged with the DETROIT STEEL PRODUCTS Co., as the Erie division . . . INDEPENDENT PNEUMATIC TOOL Co. has opened a new administration building at its main works, Aurora, Ill. . . . TIMKEN ROLLER BEARING Co., Canton, Ohio, in the first four months of this year "plowed back" into the business a total of $1,836,870. . . . The recently-formed MORTON-GREGORY CORP. of Michigan has bought the assets and patents of the NELSON STEEL WELDING CORP., Lorain, Ohio . . . UNIVERSAL CONCRETE PIPE Co., Rochester, N. Y., has begun the manufacture of small-size sanitary sewer pipe . . . ELECTRIC STEEL FOUNDRY, Portland, Ore., is expanding its new Danville, Ill., plant . . . B. F. GOODRICH Co., Akron, Ohio, reports that twice as many conveyor belts are being produced now as compared with 1940 . . . The name of THE AMERICAN ROLLING MILL Co., has been changed to ARMCO STEEL CORPORATION . . . THE PATENT SCAFFOLDING Co., INC., has opened a new branch office and warehouse in Seattle,

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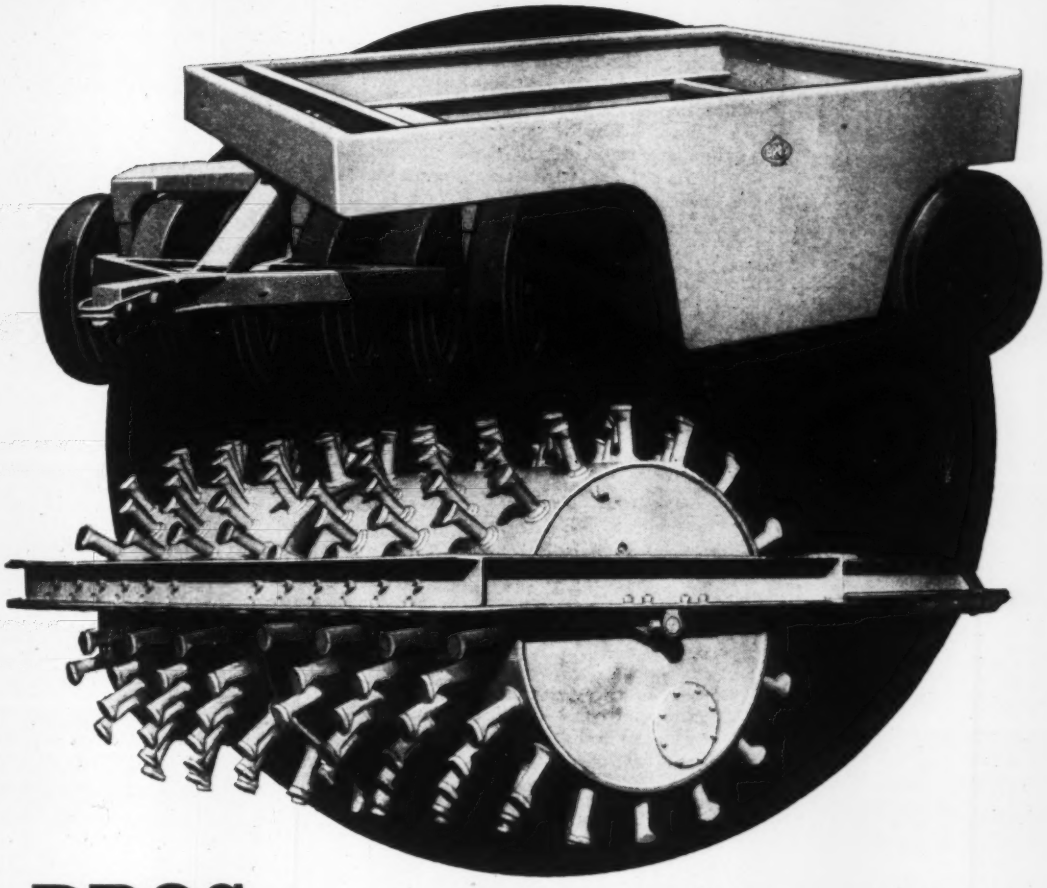

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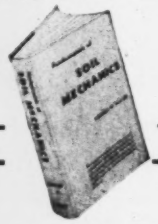

CONTENTS

Introduction
Preliminary Consideration
Simple Soil Tests and Classifications Tests
Classifications
Subsurface Investigations
Permeability
Weights, Stresses and Heads, Seepage Forces
Capillarity
Seepage
One-Dimensional Consolidation
Use of Elastic Theory of Estimating Stresses in Soils
Settlement Analysis
Strength Theory
Shear Testing Methods. Shearing Characteristics of Sands
Shearing Strength of Cohesive Soils
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Wash. . . . Charles R. D'Olive has been appointed vice-president and general manager of newly-created INGERSOLL UTILITY UNIT division of BORG-WARNER CORP. HALL LABORATORIES, Pittsburgh, Pa., water-control engineering firm, is making a transfer of service engineers in the Pittsburgh, Cincinnati, Ohio, and Birmingham, Ala., districts. Leonard Highley, Jr., with the company since 1932, returns to the Pittsburgh offices after nine years' service in Birmingham. G. Howard Smith, who joined HALL LABORATORIES in 1940, leaves Cincinnati after four years there, to work in the Birmingham district. Robert G. Hobek, who joined the firm in 1939 and has served in laboratory work, joins the service engineering staff in Cincinnati.

New Engineering Books

(*Continued from page 96*)

PHOTOELASTICITY—Volume II—By Max Mark Frocht. 505 pp. John Wiley & Sons, Inc., New York. $10.

CHOOSING VALVES—Third Edition—By P. L. Boucher. 92 pp. Kilmarnock, Glenfield & Kennedy Ltd., Kilmarnock, Ayrshire, Scotland.

FORMING OF AUSTENITIC CHROMIUM-NICKEL STAINLESS STEELS—By V. N. Krivobok and George Sachs. 309 pp. The International Nickel Co., New York. $4.

RESULTS OF PUBLICLY-OWNED ELECTRIC SYSTEMS—Ninth Edition—By Burns & McDonnell Engineering Company, P. O. Box 7088, Kansas City, Mo. 384 pp. $10.

A.S.T.M. STANDARDS ON PAINT, VARNISH, LACQUER, AND RELATED PRODUCTS—Prepared by Committee D-1 on Paint, Varnish, Lacquer, and Related Products. 565 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $4.35.

A.S.T.M. STANDARDS ON CEMENT; Specifications, Chemicals Analysis and Physical Tests. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $2.

AERIAL PHOTOGRAPHS IN FORESTRY—By Stephen H. Spurr. 340 pp. The Ronald Press Company, New York. $6.00.

FOREST INFLUENCES—By Joseph Kittredge. 394 pp. McGraw-Hill Book Co., New York 18 and London. $4.50.

Reports and Pamphlets

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1 Main St., Atwood. With population of about 1,500, Atwood scheduled 42,200 sq. yd. of concrete streets in '47.

2 Newly-built 5th St., Russell — part of 13,290 sq. yd. concrete street paving program undertaken during 1947.

3 Kansas Ave., Wichita, showing parking bays at right for park visitors. Wichita contracted for 264,512 sq. yd. of concrete street paving in 1947.

4 Broadway Ave., Great Bend, showing completion of concrete resurfacing project.

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A SELECTED BIBLIOGRAPHY ON HIGHWAY SAFETY—Bibliography No. 2—Highway Research Board, 2101 Constitution Ave., Washington 25. $.45.

MAINTENANCE METHODS FOR PREVENTING AND CORRECTING THE PUMPING ACTION OF CONCRETE PAVEMENT SLABS CURRENT ROAD PROBLEMS—No. 4 Revised Edition—Highway Research Board, 2101 Constitution Avenue, Washington 25, D. C.

COMPACTION OF SOILS—Technical Bulletin No. 120—American Road Builders' Association, International Building, Washington 4, D. C.

THE APPLICATION OF ELECTRO-OSMOSIS TO PRACTICAL PROBLEMS IN FOUNDATIONS AND EARTHWORKS — Building Research Technical Paper No. 30—Department of Scientific and Industrial Research. Obtainable from His Majesty's Stationery office, Kingsway, London, W. C. 2, England. Price 11d.

AMENAGEMENT DE LA CHUTE DE GENISSIAT—Compagnie Nationale Du Rhone, 10-12 Boulevard Jules-Favre, Lyon, France.

HOUSING STATISTICS HANDBOOK—Housing and Home Finance Agency. Obtainable from the Superintendent of Documents, Washington 25, D. C. $1.

FROM BLUEPRINT TO BUILDING—25th Anniversary Publication of Psaty and Fuhman, Inc., New York.

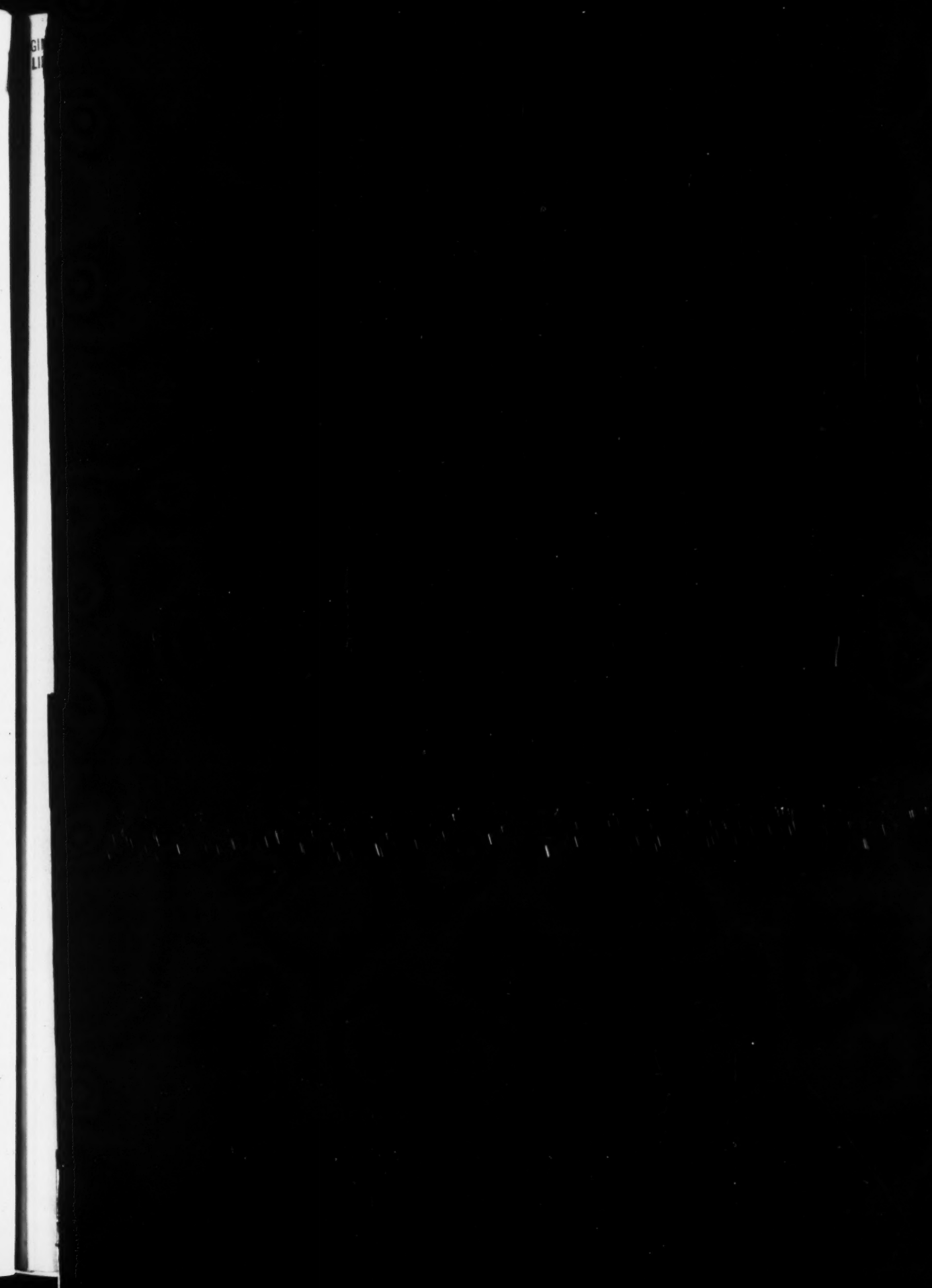
THE EXHAUST-WATER SPRAY FIRE PROTECTIVE SYSTEM FOR WELLWAYS—Otis Elevator Co., Westinghouse Electric Corp., and Grinnel Co., Inc. Available upon request from the Otis Elevator Co., 260 Eleventh Ave., New York.

A PROPOSAL FOR A DRAFT CODE OF PRACTICE FOR PRESTRESSED REINFORCED CONCRETE—Kurt Billig, 167 Victoria Street, Westminster, London, S. W. 1.

SYMPOSIUM ON MEASUREMENT OF ENTRAINED AIR IN CONCRETE—Reprinted from the Proceedings of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $1.75.

HIGHWAY SAFETY—A REVIEW AND FORECAST — Paul G. Hoffman, President, Studebaker Corp., Detroit, Mich.

CHEMICAL CHARACTER OF SURFACE WATER 1944-1946. Pennsylvania Department of Commerce, State Planning Board, Harrisburg, Pa.

DESIGN OF CONCRETE MIXES—Road Note No. 4—Department of Scientific and Industrial Research, Road Research Laboratory. Obtainable from His Majesty's Stationery Office, London. Price 4d.

EFFECT OF BATCHING ERRORS ON THE UNIFORMITY OF CONCRETE—Road Note No. 3—Department of Scientific and Industrial Research, Road Research Laboratory. Obtainable from His Majesty's Stationery Office, London. Price 4d.